Potential economic and social impact of land and building tax an evaluation of the property assessment system in Bangkok

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Awarding institution:
King's College London

Potential Economic and Social Impact of Land and Building Tax:

An Evaluation of the Property Assessment System in Bangkok

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A thesis submitted for
the degree of Doctor of Philosophy (Ph.D.) in Geography

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May 2020

Declaration of Originality

I, Dit Maneepitak, confirm that the content of this thesis is my own work.
Where information has been derived from other sources, explicit reference is made to the contribution of others. This thesis has not been submitted for any other degree at King's College London or any other institution.

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Word count: 72,586

Abstract

Property tax is an important source of finance for local governments, which directly affects the extent to which they can make autonomous expenditure decisions. Although the literature indicates that, in principle, property tax causes less economic distortion than other taxes, in practice, designing and administrating an effective and impartial mechanism to enforce the tax remains challenging. Many countries including Thailand have avoided the formal market-price assessment of estate property and substituted it with non-market approaches because of budgetary and time constraints. The main concern is that spatial inequality marks an important price-determining and location-associated factor, yet it is not taken into account systematically in the process of deriving the suitable property tax level. This study investigates what constitutes spatial inequality in property assessment and how we might improve the parity of the property tax system. The underlying hypothesis is that anomalies in the property tax system vary systematically across the study area and the problem inherently lies in the property assessment process. The study focuses on the private housing market of Bangkok as an empirical case study due to its diverse and complex patterns of land use.

Given the infrequent property reassessment cycle and the adoption of the mass appraisal approach, a large proportion of the assessed price in Bangkok fails to reflect the market price. The *fairness* of the property tax system is therefore examined by measuring the accuracy of the assessed price using both spatial and non-spatial techniques. Drawing on the cadastral and the property data, the study employs three main methods: assessment ratio analysis, spatial autocorrelation analysis (local Moran's *I*) and geographically weighted regression (GWR). Findings confirm the regressivity of property tax where owners of lower-priced homes are generally liable to proportionately higher tax than owners of high-priced homes are. The study also found signs of systemic biases in the property assessment that are area-specific. Over-assessed properties are largely concentrated in the suburban areas where property market prices are relatively lower than in the city centre and inner city areas. These findings present a clearer case of spatial inequality in property taxation than has been previously suggested. The study thus makes a novel contribution to the literature of housing economy as well as urban inequality through the interpretation of the spatial patterns of the housing market in Bangkok and offers recommendations for local tax policy with the aim of improving spatial justice.

Dedication and Acknowledgements

Mom and dad, I love you.

This research is dedicated to my family and colleagues. It would never have been accomplished without your encouragement.

This work would never have been possible without the advice from my supervisors, Dr Narushige Shiode and Dr Jonathan Reades.

I would like to thank Ms Wilawan Veerakul of the Treasury Department for her strong support. I am also grateful for Acting Lieutenant Yunyong Arunyagasemsuk, Mr Santi Saisakul and Mr Apirat Rattanaphaiboon of the Property Valuation Bureau for providing property data, cadastral maps and property assessment manuals.

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Acronyms

AIC: Akaike Information Criterion

A/S Ratio: Assessed to Sale Price Ratio

BMA: Bangkok Metropolitan Area

BMR: Bangkok Metropolitan Region (BMA) and its surrounding provinces

BTS: Bangkok Mass Transit System (elevated railway commonly referred to as 'Skytrain')

CBD: Central Business District

COD: Coefficient of Dispersion

GWR: Geographically Weighted Regression

IAAO: International Association of Assessing Officers

IHT: Inheritance Tax

IMF: International Monetary Fund

LOA: Level of Assessment

LVT: Land Value Taxation

MAUP: Modifiable Areal Unit Problem

MRT: Metropolitan Rapid Transit (underground train)

OECD: Organisation for Economic Co-operation and Development

PRD: Price Related Differential

PVB: Property Valuation Bureau (in Thailand)

RICS: Royal Institution of Chartered Surveyors

VIF: Variance Inflation Factor

"…[Property tax is] not unpopular for good economic reasons.
It's unpopular, in my opinion, for one simple reason.
It's the only tax left on the books for which people have to write a big cheque.

The income tax is a far worse tax, but, and I have to admit that I have
some part of the guilt in this process because, during World War II,
I worked at the Treasury and helped to design the withholding system.
My wife has never forgiven me for it."

Milton Friedman
An interview at Human Events
November 18, 1978

Chapter 1 Introduction

The importance of taxation in the development of public infrastructure and services can never be overstated. This is because taxation is a major income source for government in most countries. For local governments, property tax is, at least potentially, an important source of revenue. It is a fiscal instrument from which a direct relationship between taxpayers and local service users can be established. Economists support property tax for two main reasons. One is that land is a highly visible base for taxation; and the other is that a considerable amount of economic rent is taxed, particularly when land is an important part of tax base. Therefore, compared with other taxes, property tax should, in theory, be a preferred option in terms of public revenue contributions.

Property tax is one of the oldest forms of taxation in human history and it still exists all over the world. In ancient times, dating from approximately six thousand years B.C., agricultural land was the primary focus of early property taxation. Property tax was based on production value—i.e. crop yields and number of cattle—because the bookkeeping system was not advanced enough to allow tax assessors/collectors to determine the appropriate tax amount on income or transactions (Carlson, 2005). Not until the colonial period did the valuation of land begin to be based on income and property transactions, a system that emerged along with the development of modern towns and accounting practices (Ibid.).

Property tax structure has become more complex as it has evolved over time. Nowadays, we can see many types of tax imposed on various classes of property at various rates. Property tax differs from country to country—and, in some cases, from state to state—due to different political regimes, local government systems, fiscal structures, government financial requirements, etc. But what most countries have in common is the difficulty of implementing or making changes to property tax, as it is politically unpopular (because of its high visibility).

> …Unlike the income tax, for example, the property tax is not withheld at source. Unlike the sales tax, it is not paid in small amounts with each daily purchase. Instead, the property tax generally has to be paid directly by taxpayers in periodic lump-sum payments. This means that taxpayers tend often to be more aware of the property taxes they pay than they are of other taxes (Bird and Slack, 2004a, p. 12).

Other types of property tax apart from those imposed on real property are difficult to administer. Personal property tax, for instance, can be easily evaded because personal properties—e.g. jewellery, watch or car—can be hidden and moved. Therefore, the term 'property tax' typically refers to 'real property tax'. In this study, the term 'property tax' specifically refers to the recurrent tax on immovable property, excluding property transaction tax such as stamp duty land tax (SDLT).

In Thailand, property tax is by far the most important source of local government revenues. Between 2008 and 2017, the two recurrent taxes on property (Building and Land Tax and Council Tax) contributed altogether about 70 per cent of self-collected revenues of local governments (Fiscal Policy Office, 2017). However, these two taxes are considered by the government obsolete and not suitable for current local government structures and financial needs. Accordingly, a new type of property tax called 'Land and Building Tax' was introduced in March 2019 and will become effective in August 2020. The Land and Building Tax is simply a combination of the two previous property taxes with a more comprehensive tax structure, covering all classes of properties (with some exemptions and reductions). The tax can be considered an ad valorem tax because it is based on property assessments provided by the Property Valuation Bureau (PVB).

In this study, the evaluation of the property tax system begins with the tax base, which is the assessments of the PVB. The core analysis is based on the assessed values of residential properties in Bangkok, including all housing types. Housing market is the main focus of this study for two reasons. First, housing forms a majority of the property market in Bangkok, and presumably in many other cities as well. Residential properties account for almost four-fifths of total properties in Bangkok (PVB, 2016b).This means the spatial distribution patterns of residential properties are more consistent and prevalent throughout the study area compared with other types of property, resulting in more reliable and meaningful research findings. Second, the range of housing is a good reflection of the city's different social classes. Owners and occupiers of residential properties come from a wider range of income groups and occupations than, for example, those of commercial properties, which may be limited companies. Furthermore, the ownership structures for commercial properties are more complex.

Both efficiency and equity aspects of the assessments are considered, but more emphasis is placed on the latter. The assessment data comprises all types of housing,

and dates back to 2008, covering three assessment cycles. Another data set has been drawn from the Land Registry, and a similar set of data from the PVB's surveys is used to ensure accuracy during the data cleansing process. This study also uses data on property tax/assessment and relevant policies to identify tax rates, discounts and exemptions. Although these factors do not form a direct influence on property tax incidence, their extent can determine the level of tax contribution in the long term. However, because the implementation of the Land and Building Tax is still in its early stages and there is a lack of data on tax amounts, this study will not focus on the calculation of the tax incidence. The main analysis will involve only the assessment component of the tax.

The remainder of this chapter presents the theme of the thesis and how it can contribute to the study of property tax and the housing market. The main subject of the thesis is presented in the first section (1.1), followed by the significance of this research in Section 1.2. Section 1.3 introduces four main research objectives, and Section 1.4 addresses key research questions. The following sections describe the key hypotheses, scope and limitations, and outline of this thesis.

1.1 The Subject of the Thesis

This thesis discusses the anomalies in the property tax system in Thailand and their impact on society and the economy. Since property assessment is the cornerstone of the property tax system, it is essential that the assessed price is accurate and able to reflect the market price. Inaccurate property assessment jeopardises the fairness of the property tax system, decreases its revenue raising ability, and creates distortions in the economy (Payton, 2012). The property tax system is evaluated in terms of the inaccuracy of the assessed price and potential systemic bias in the assessment system. This study analyses the spatial distribution of, and the correlation between, several factors that play an important role in the housing market. Bangkok is chosen as a case study area, in which properties located throughout 50 boroughs are included. The two most important aspects of this research are: the investigation of the property assessment as a base of the property tax to find the degree of assessment equity and bias; and the discussion about the impact of assessment inequity from the economic, social and geographical perspectives.

Economic inequalities that arise from the anomalies in the property tax system are due to two important reasons. First, the proportion of housing cost spent by poor households is relatively high (Harris and Lehman, 2001), which makes them more vulnerable to poorly designed and administered property tax systems (e.g. regressive tax rate and unfair distribution of tax burden). This problem has long-term impact on the housing market as the property tax capitalises into housing price. It is also evident that owners of cheap homes are likely to benefit less from the property tax system. The (property tax) appeal procedure has been more frequently made use of by owners of expensive homes who are likely to be better educated and better informed of their rights (Ross, 1971).

Second, it is not unusual for assessment ratio—the proportion of assessed to sale price—to vary systemically across geographic areas. Studies of Indiana, Pennsylvania, Taipei, and several cities in Israel all point to a systemic variation in property tax rates across urban and suburban areas (Black, 1972; Heavey, 1983; Horne and Felsenstein, 2010; Lin, 2010; Payton, 2012). Property tax rates may be uniformly higher in inner city areas than in suburban areas (Black, 1972) or vice versa (*inter alia*, Heavey, 1983). However, it is evident that assessment bias occurs systemically, regardless of the kind

of neighbourhood in question. Again, these flaws embedded in the tax system tend to have the most negative impact on low-income households.

1.2 Significance of this Research

Should we allow the property market to behave freely without any interference from the government? Before answering this question, an anecdote about the scalping of campsites in Yosemite National Park, California, provides potential insights (Sandel, 2012). Yosemite attracts over four million visitors a year and there are about nine hundred available campsites, which can be reserved in advance at a nominal cost of $20 per night. The demand is so enormous that the available sites are fully booked within minutes of becoming available. This creates an opportunity for scalpers to resell the reservations on Craigslist for $100 to $150 per night, despite being prohibited by the National Park Service.

Advocates of the free market would argue that the scalpers should be welcomed because they offer the reservations to people who value the experience the most, as measured by the willingness to pay. Alternatively, the National Park Service could raise the price of campsite reservations to a level that eliminates the excess demand in order to maximise the state benefits and prevent the scalping. But either case is obviously unfair for people of modest means who cannot afford the market clearing price. In this regard, Sandel (2012) believes that market values are appropriate for some goods but harmful for others. Before we apply the free market logic to certain kinds of goods we must first decide how they should be valued. This very much depends on social norms, which are debatable and always subject to change.

The housing market is similar to the case of Yosemite National Park in that it consists of people of all income levels, which means that we cannot use the willingness to pay as a fair measure to justify the market price. Capitalism makes it possible for people to accumulate wealth, as witnessed by the fact that in most economies the rich are getting richer and the poor are getting poorer. At the heart of the problem is the fact that the ‘top one per cent’ richest people own the majority of capital in a society, leaving a handful of wealth to the remaining ninety-nine per cent (Stiglitz, 2013). This is the reason why the market values are corrosive of justice in the housing system. Without government intervention such as property tax and capital gains tax, wealthy people can freely invest in housing, either reselling or letting for profit, while the poor, especially those with bad credit, can hardly access the market. Economic inequalities arise as property-rich people gain more wealth from economic rent—unearned income from the ownership of property.

Economic inequalities are commonly recognised in the form of income, pay and wealth. In a sense, pay inequality is a subset of income inequality. Pay means a payment from employment only, while income could be money received from employment, investments, pensions or rent. Wealth inequality refers to the unequal distribution of net assets (total assets minus liabilities). A large part of wealth inequality is contributed by income inequality, particularly from investments and rent in the real estate market. This makes wealth inequality runs even more pronounced in many countries, as evident in a continuing increase of land and uinet national wealth to net national income ratio (see World Inequality Database, 2020). As well, Piketty (2014) asserts that rising inequality in recent decades can be explained by the fact that the rate of return to wealth—'capital' in Piketty's terms—has exceeded the rate of economic growth. He also claims that inherited wealth has grown faster than the growths of output and income, and taxes on capital play a central role in alleviating the problem. In the UK, for example, housing wealth has been found to have increased faster than the growth rates of either fiscal or non-fiscal wealth (Ryan-Collins et al., 2017).

In Thailand, wealth and income inequalities are pressing problems and they are in part associated with inequality in the distribution of land ownership. Laovakul (2013) found that Thailand has a relatively high wealth Gini coefficient of 0.886, and the proportion of land ownership among the fifth quintile of the population is 326 times greater than among the first quintile. As described in Thailand's 12th National Economic and Social Development Plan (2017-2021), the government claims that 'the fundamental cause [of income disparities] lies in geographical disparities in the quality of social services, an imbalanced economic structure, uneven distribution of development opportunity and unequal access to justice' (NESDB, 2017, p. 14). One of the solutions that has been prioritised in the national agenda is the reform of the property tax system, which aims to encourage more efficient and evenly distributed land use through the adjustment of property tax rates and bases—i.e. higher rates on vacant lands and wider tax bases—as well as the whole tax structure.

Nonetheless, moving from one type of property tax to another, or even undertaking a reassessment, is not practically viable. There are of course some costs involved in the reassessment process but they are not considerable compared to the potential revenue that can be raised. In the UK, for instance, the case for the council tax reform has

become overwhelming as the research by the Resolution Foundation shows that the regressivity problem of the tax has the most negative influence on young adults and the poor (Corlett and Gardiner, 2018). Not only has the Council Tax system failed to capture dramatic increases in housing wealth (especially in London), but it has also proven inadequate in raising sufficient funds to pay for essential local services (Wolf, 2018).

One of the policy options to improve the property tax system is to have systematic and regular reassessment. In the UK, it is estimated that the reassessment cost could be as low as £3.24 per property, and it could be even lower if hedonic modelling is adopted (Policy Exchange, 2013). It is in fact the politics behind property taxation that makes the reform extremely difficult, either because of the fear of windfall gain and loss, or because of the notion that a rise in Council Tax would impose hardship on the housing-rich, income-poor—e.g. pensioners. However, the UK can hardly deny the fact that the ratio of wealth taxes to GDP has stagnated (Wolf, 2018), which means that the rise in Council Tax has mostly affected middle to poor income households, as defined by the eight broad tax bands.

In Thailand, it took over 20 years following the first attempt just to have a new property tax legislation approved by the (junta) cabinet. Now the tax legislation has been passed by both houses of parliament and it will become effective in August 2020. The lack of flexibility in the property tax system implies that the initial design of tax structure is crucial to the efficiency and effectiveness of the tax in the long term. Therefore, this study prioritises not only the evaluation of the property assessment process but also the administration of the property tax itself.

The new ‘Land and Building Tax’ legislation has been drafted to replace the two currently under-utilised property taxes. The property tax has been reformed because it is considered one of the least distortionary taxes. In general, taxation distorts the markets through the increase in price of affected goods (Kling et al., 2010) or the change in people’s decisions particularly on consumption, working, investment and saving (Boskin, 2016; Mirrlees et al., 2010). The distortionary impact depends largely on the elasticity of demand and supply for certain kinds of goods. In the case of the property tax, the supply of land is fixed and inelastic, but the supply of improvements is more elastic—greater than zero. Imposing tax on land alone does not significantly affect people’s behaviour but imposing tax on improvements can in fact discourage

developments. The inclusion of improvements in property tax base would distort incentives, meaning that landowners would respond by devoting fewer resources to improving their land (Mankiw, 2014).

Property tax is a local tax by nature because it tends to encourage taxpayers (as voters) to be aware of the costs of local public services and the spending of local revenues, and thus enhances the accountability of local governments (Bird and Slack, 2004a). Property tax base is highly visible because the ownership of land can be easily established. It is ideal to have the most inclusive and large tax base (as many housings) possible, which means that there are more tax contributors and stakeholders included in the decision-making process of local authorities.

It is therefore important to have accurate property assessments (tax bases), decent tax rates, and a well-functioning property tax system. Beginning with the analysis of the property assessment, this study attempts to identify patterns of systemic assessment biases and address assessment equity problems by first establishing a connection between assessed and sale price, showing the extent to which assessed price has failed to catch up with the sale price in each area of Bangkok.

Most property tax studies in Thailand (Ananapibut, 2012; Laovakul and Phichaisanit, 2012; Varanyuwatana, 2004) focus on comprehensive fiscal reforms and present broad suggestions on the structural modification of property tax. However, no study has ever closely looked at the economic incidence nor the functioning of the property tax system. Incidence studies of other types of taxes could hardly be applied to property tax research because the property tax has several distinct characteristics of the tax base and rate. For example, property tax is a consumption tax when levied on rental housing, but it could be considered both a consumption and an investment tax when levied on owner-occupied housing.

Other studies on spatial distribution of residential property price in Bangkok (Malaitham *et al.*, 2013; Vichiensan and Miyamoto, 2010a, 2010b; Vichiensan *et al.*, 2011) were carried out before the openings of many new urban rail transit systems, and the methodology used in their studies is limited to hedonic regression and geographically weighted regression (GWR) modelling of commercial and high-rise residential properties. No comprehensive study of housing in Bangkok in terms of spatial equality has been carried out previously.

This study offers a new analytical approach in the evaluation of the property tax system and tax incidence distribution. It combines the simultaneous examination of property assessment performance, geographical distribution of tax incidence and urban policy conditions to identify the influence of property tax on taxpayers' welfare and benefits. Based on the assumption that the validity of the property assessment depends on the extent to which it can accurately estimate market values, key underlying market determinants are examined along with the ratio analysis of the disparity between assessed and sale prices.

Some studies have attempted to evaluate inequity in the property assessment system without considering spatial factors (Harris and Lehman, 2001; Lin, 2010; Payton, 2012), while other studies have tested for the capitalisation of the property tax into house prices (Chalermpong and Wattana, 2009; Hamilton, 1976; Zodrow, 2008). The theoretical framework of this thesis has built on these studies by including the analysis of urban forms to reveal important development patterns that may be relevant to the property tax system.

The originality of the methodology used in this study is the construction of separate spatial regression models to address various effects of inconsistency and bias in the assessment system, as well as the application of both spatial and non-spatial techniques. Although the tax base (in this case referring to the assessed price) is quite rigid, tax incidence is largely determined by tax rates and spatial variation in assessment level. The use of different methods allows this study to expand the analysis beyond a simple tax burden determination.

Unlike other researches that perform partial analyses, the data used in this study is more comprehensive as it has been drawn from the whole Bangkok metropolitan area (BMA), which covers boroughs of different levels of urbanisation and development. Also, spatial autocorrelation analysis of property assessments is new in the context of Bangkok. Past literature has employed partial ratio analyses and hedonic regression models in the analysis of property assessment performance (Chalermpong, 2007). The use of both spatial autocorrelation and GWR analyses can help to better explain uneven spatial distribution patterns of property price in Bangkok. These methods provide for a more holistic approach to the study of the impact of anomalies in the property tax system.

1.3 Aim and Objectives

As we saw in Section 1.2, the property market has created lots of opportunities for wealth accumulation. People with advantages in terms of property wealth can gain more money faster than people with limited resources. If this situation continues without appropriate fiscal countermeasures, the wealth gap will inevitably increase. These fiscal measures can take various forms such as housing policy and direct subsidy, but property tax is perhaps the most widely used. Yet few countries have succeeded in utilising property tax to its full potential. I believe this is partly because of the lack of accurate property assessments, which form an actual base for the tax. This problem calls for immediate academic work to seek and analyse reliable evidence regarding the property tax assessment system in Thailand. Therefore, this study aims to understand the impact of the performance of residential property assessments on the working of the property tax system in Bangkok. The property assessments are compared with sale prices to determine the degree of discrepancy, and are also analysed in relation to several factors to explore the level and spatial distribution pattern of their influence.

There are four objectives in this study. Firstly, the study will explore existing knowledge in the fields of urban economics, fiscal economics, property taxation and property assessment. This will be carried out by reviewing relevant literature to establish a conceptual and policy framework for this study. The second objective is to investigate the nature of the property assessment system in Thailand. The investigation emphasises the degree of uniformity between, and spatial distribution of, different assessed value ranges in the case study area. This also includes determining the spatial distribution of the discrepancy between assessed and market prices. The main purpose is to identify geographical areas where inherent biases and related problems in the assessment system exist. The third objective is to identify important variables that determine housing assessed prices in Bangkok, which is done using GWR. The final objective is to discuss and synthesise research findings to produce policy recommendations, and to make contributions to existing knowledge on property assessment for taxation and suggestions for future research.

To achieve the first objective, I begin with a review of the economics of taxation, which is part of fiscal economic discipline. The key theories are policy choice between direct and indirect taxation, optimal tax structure and progressivity of tax rate in

relation to economic inequality. The concepts of equity and efficiency in taxation are discussed to establish a conceptual framework for later discussion on property tax incidence and administration. The review of the literature moves on to the spatial aspect, which includes the theories of land use, urban form and related problems. Subsequently, we discuss in detail the theory of property taxation using the framework set out in the early chapter. The discussion also includes evaluation of the property tax system in terms of distribution and stabilisation functions, property assessment for taxation, house price determinants and property tax reform.

The second objective will be achieved by the empirical analysis of property assessments in terms of growth, and spatial distribution and variation in relation to sale prices. The analytical approaches employed to achieve this aim are assessment ratio analysis and spatial autocorrelation analysis. The analysis is based on the framework of horizontal and vertical equity, which is within the scope of the ability to pay principle. Income is normally used as the index of the ability to pay. A horizontally equitable system would place similar burden of payment on people with the same level of income, and a vertically equitable tax system would place higher burden of payment on people with higher income (Musgrave and Musgrave, 1989). However, this concept does not directly apply to the case of property taxation and housing studies because the owners (or occupiers) of higher value properties do not always earn higher income. For example, retired people who own big, expensive houses may live on small pensions and no longer have other income sources. But in this study, it is assumed that owners of higher priced housing have higher ability to pay.

The third objective concerning the identification of housing price determinants can be achieved through GWR analysis. These determinants of housing assessed prices are important to this study because they can reflect the property assessment process. The data on housing variables is provided by the PVB and the land registry, and some of the variables are calculated by the author using ArcGIS. The findings from GWR analysis will be compared with the analysis using the previous two methods (mentioned in the second objective) to confirm the validity of research results. The findings will also be discussed in relation to those of previous studies. This main purpose is to form a basis for the final chapter: discussion and conclusion.

The last objective is the discussion of research findings and the formation of new knowledge in assessment method and property tax structure. This will be achieved by

synthesising the findings of this study and of the wider literature. The body of knowledge contributed by the synthesis will be compared with the current standard on property assessment in Thailand. Offering suggestions for assessment and property tax reform based on empirical evidence is the ultimate goal of this study. The validity of the evidence is confirmed by cross examination of the data and the use of internationally recognised analytical methods. In short, this work is an empirical study attempting to quantitatively evaluate Bangkok's housing assessments with the aim of improving their accuracy and equity. It is hoped that the results of this study will help justify the use of property tax as one of the important fiscal instruments in Thailand.

1.4 Research Questions

The research objectives laid out in the previous section have been formulated in a logical order according to the process undertaken in this study. The key problem is whether or not assessment inequity exists and, if it does, what seem to be the main causes, and how does it affect property tax incidence. In an attempt to address this problem, the following research questions arise:

(1) How uniform and progressive is the assessed price?

(2) Are there any systemic biases in the distribution of assessed price in particular areas of Bangkok? And if there are, do these imply fairer or less fair distribution of the property tax incidence?

(3) What are the geographical distribution patterns of the discrepancy between assessed and market prices, and do areas with disproportionately high discrepancy between assessed and market prices have any particular characteristics—compound of new housing developments, recently developed infrastructure, areas that have been gentrified, etc.—that make those neighbourhoods unique?

(4) Are there any groups of cohorts—as defined by property value—that benefit from the discrepancy and uneven geographical distribution of assessed prices? If so, are they concentrated in any particular areas, and what are special about these areas?

(5) Does the assessment standard, which informs the working assumptions of assessors, accurately identify and describe the influential determinants of housing assessed price in Bangkok? If not, what, in reality, are the key determinants?

(6) What are the appropriate property assessment approaches that can produce more equitable tax liability, and to what extent will this help improve the property tax system in terms of a more suitable tax base, rate and structure?

1.5 Formulating Hypothesis

As the collection of the Land and Building Tax has not yet come into effect, it is difficult to judge either its effects or performance. If the tax had already been in operation for a number of years, we would have had concrete data relating to tax amounts. We can make predictions based on the capitalisation of property tax into property prices, but until the tax is implemented, any discussion based on these predictions would be of limited value (*inter alia*, Hamilton, 1976; Hilber and Lyytikäinen, 2017; Plummer, 2003). In light of this, I have developed six realistic hypotheses.

Underlying this research is the hypothesis that assessments in Bangkok are reasonably uniform due to the practice of deriving assessed prices from street values—a single value is determined for each street or part of street. Uniformity in assessments is further reinforced by a rigid assessment system that restricts price adjustment to every four years. Therefore, spatial distribution patterns of assessed prices tend to be area-specific, and a smooth transition of prices between adjacent areas or submarkets is expected.

Second, it is expected that the housing assessed price tends to diverge from market price because the sets of factors valued by assessors differ from those valued by the market, and this divergence tends to vary within and between geographic areas. Given rigid and peculiar institutional constraints placed on the property assessment system in Thailand, the assessed price normally lags behind the market price by 30 per cent on average (PVB, 2016b). More frequent assessment and the improvement of assessment standards can promote horizontal and vertical equity within the property tax system.

Third, considering the importance of the market assessment approach adopted by the PVB, some might assume that transaction price is the most influential determinant of the assessed price. This, however, does not seem to be the case. In fact, the PVB uses both market and cost approaches, the former for vacant land assessment and the latter for building assessment. In most cases, building values account for a small proportion of the total assessed values because they are calculated from mean building costs rather than from detailed assessment. Vacant land values, on the other hand, are derived from actual transaction prices, but sale data of properties on similar streets are grouped to calculate a mean price for each street unit. Therefore, although the variation

in assessed prices seems to be directly affected by transaction prices, the comparable sale selection process plays a more important role in final price determination.

Fourth, the level of urbanisation is believed to play an important role in the assessment process. Property density reflects the level of urban development, and it is determined by assessors during property surveys. A popular question among assessors is: 'is this neighbourhood/area developed compared with another?'. After property surveys, however, assessors have yet to establish a reliable method for measuring development, and tend instead to reach arbitrary judgements based on anecdotal observations and unstructured discussion. In a mass appraisal system, the comparison of urban development levels is not limited to one type of property. All types of properties are collectively considered in the determination of urban development level. Areas with more commercial properties usually receive higher assessed prices because they are considered to be more 'developed' despite certain negative impact—e.g. traffic noise, pollution, dirtiness.

Fifth, in terms of the development of residential areas, the east side of Bangkok is considered a more attractive location compared to the west side. The intensive urbanisation of the city began in the early 1910s with the expansion of roads in the east to connect government offices, hospitals, schools and other public amenities. West Bangkok was not part of the urbanisation plan until 1926 when Rama VI Bridge was completed, the first to cross the river; a second bridge followed three years later (Tangcholthip, 2001). However, as most public amenities were located in the east side and transportation from the west remained restricted, residential development in the east continued to outpace and exceed that in the west. By the time two more bridges were opened in 1959, the level of urbanisation in the east side was already much higher than that in the west. Today, Bangkok has twelve bridges, including four main roads[1] and a ring road network connecting both sides of the city. Therefore, there have been an increasing number of residential developments in the west side, but their average prices are not as high as those in the east.

Finally, with respect to property assessment approaches that have the potential to produce more equitable tax incidence distribution, I believe that the abolishment of the sale data selection process and more frequent reassessments would make assessed

[1] The main roads include Petch Kasem, Bharomrat Chonnani, Ratchapruek-Nakhon-In (via Rama V Bridge) and Ratchapruek-Nakhon-In (via Taksin Bridge).

prices more reflective of market price. The sale data selection process is unreliable because it relies on the subjective judgements of assessors. Strict standards that must be followed—e.g. coefficient of dispersion (COD) and coefficient of variation (COV)—have reduced the number of effective data. The selections are based on a small number of data because many sales are regarded as outliers and are eliminated to keep COD/COV values below 10 per cent. A more frequent reassessment can be achieved by computer-assisted approaches. There are several computer-assisted mass appraisal approaches such as the determination of reference land parcels by regression modelling, which enables the inclusion of more data and accelerates the assessment process. These reference land parcels are then used to calculate assessed price for each property in the same submarket or neighbourhood using price adjustment techniques—e.g. weighted quality score and grid adjustment.

1.6 Scope and Limitations of this Research

This study looks at the case of Bangkok as the focal area for the evaluation of the property tax system. The empirical research is carried out to quantify the level of assessed price disparity from the market price, and the trend of assessment anomalies. This study focuses on the assessed price because it is used as the base for the Land and Building Tax, which has been designed specifically to fund the local governments and to help encourage more efficient land use. This very same assessed price is also used as a base for the SDLT. But the scope of the analysis in this study is limited to the measurement of its performance as a base for the Land and Building Tax, and to show the magnitude of inequity caused by assessed and sale price disparity.

The main concern of this study is the limitations of the sale price data, which may not always accurately reflect the assessed price data. The problem of the time lag between the point of property sales and the period during which the properties were assessed can hardly be precisely addressed in practice. The assessed price data included in this study has been drawn from three assessment cycles (2008-11, 2012-15 and 2016-19). The most pragmatic approach seems to be the matching of property sale data to the appropriate assessment cycles. To obtain more meaningful results, the timing of the sale price data used in this study is approximately the same as that used in the assessment process. Some methods used in this study seem in a way like the reverse engineering of the official assessed price. However, the analysis based on these methods is carried out only to verify the assessment data used in this study. The main analytical approaches are obtained from the literature and include spatial approaches, which have been used to justify the spatial distribution of property price.

Evaluation of the property tax system would be more precise if a way could be found to measure displacement triggered by property tax pressure. There is currently no data that exists that would allow this kind of analysis. Of course, many have anticipated that the Land and Building Tax will cause the costs of owning or renting property to rise according to tax rates. However, the outcome of such anticipation is intangible and unreliable due to the wide variation in tax exemptions and reductions. Therefore, this study adopts realistic approaches to analyse the property assessment system in relation to certain market determinants.

1.7 Structure of this Thesis

This thesis consists of four components that are formed around the theme of property taxation and spatial justice. The first component captures the theme of the economics of taxation in general as well as property tax in relation to the concept of urban geography. Chapter 2 presents important developments in urban economic and fiscal economic theory with respect to the concepts of spatial (in)justice. The main theme of the discussion is concerned with the equity and efficiency aspects of tax policies. The last section of the chapter reflects an attempt to establish a clear connection between urban system and tax structure. Chapter 3 narrows down the discussion to the concept of property taxation and the criteria by which property tax can be evaluated. The departure from the classic concept of the concentric urban form has made it difficult to capture property value in modern cities, especially those with complex urban structures and unsystematic city planning. Selected determinants of housing prices are discussed at the end of the chapter.

The second component begins in chapter 4, which covers the background to the empirical study of the property tax system in Thailand and the property assessment process in Bangkok. The chapter begins with the local government structure in Thailand then moves to an overview of the geography of Bangkok and the property tax system. The final section of the chapter covers the property assessment practice which is the fundamental concept under analysis in this study. Property assessment in Thailand may be derived from market price but this does not mean that the assessed price is always kept up-to-date. The four-year assessment cycle and the employment of the mass appraisal[2] approach have caused the assessed price to divert from the market price in a way that is believed to cause social inequality, the hypothesis from which the research questions have been drawn.

The third component concerns the analytical methods used in this study, which are presented in chapter 5. The three key methods used in this study are ratio analysis, spatial autocorrelation analysis (local Moran's I) and GWR. Ratio analysis is the study of the difference between assessed and sale price, and the term 'ratio' refers to 'assessment ratio', in which assessed price is expressed as a proportion of sale price. The method is specifically designed to measure assessment inaccuracy in property tax

[2] Mass appraisal—or mass assessment—is defined as "the process of valuing a group of properties as of a given date and using common data, standardised methods, and statistical testing" (IAAO, 2017, p. 5).

systems (IAAO, 2013b). As I have investigated the spatial distribution of the ratio, the results can be used to identify the tendency of assessment problems to manifest at borough/jurisdiction level. The local Moran's I is used to examine the patterns of assessment problems at individual property level, and to find clusters of inaccurately assessed properties as well as anomalies in the sale price data. Finally, GWR is used to determine the relationship between some key variables that are believed to have different impact on assessed values.

The last component of this thesis presents data analysis, research findings and discussion thereof. Chapter 6 provides analysis of property assessments, sale prices and property data in Bangkok. It presents the findings of all three analytical methods, which are performed in sequential order. Finally, in chapter 7, the findings of this study are discussed in relation to the relevant literature, research questions and hypotheses. The chapter concludes this thesis by describing research implications and recommendations for future works.

Chapter 2 Taxation and Spatial Justice

This chapter defines important concepts of, and establishes a theoretical context for, taxation in relation to urban geography. The first two sections of this chapter (2.1 and 2.2) present the general framework for taxation. The central focus is on equity and efficiency as the major criteria for the evaluation of tax systems. Section 2.3 reviews key urban economic theories, paying particular attention to the housing market. In section 2.4, I move the discussion to the geography of urban areas, which is the main arena of property taxation. Urban form is a very important concept in urban studies and the understanding of its impact on the flow of goods, people and information is crucial in explaining the relationship between tax policies and city economies. In section 2.5, I discuss in detail the concept of spatial justice within the scope of the transformation of the housing market. Section 2.6 presents some of the most pressing urban problems in modern cities, and finally the conclusions to the chapter are presented in section 2.7.

2.1 Economic Approaches to Taxation

This section reviews the strand of literature on various concepts regarding the economics of taxation. Just as fiscal economic theory saw some major developments in the 1950s, there has been a corresponding increase in studies attempting to evaluate tax systems. Several tax policies have been directly involved in the reshaping of cities and regions as part of wider economic policies. The influence of national and local taxes, and the relationship between them, are crucial to urban systems because they are important fiscal instruments that regulate the flow of capital and labour. As will be explained later in this thesis, the influence of tax policy and certain kinds of injustice that are infused into urban geographies are interrelated.

In general, taxes are compulsory imposts that contribute the largest proportion of government revenues (Musgrave and Musgrave, 1989). There are a number of criteria by which taxes can be classified: by the base on which they are imposed (income, consumption or wealth); by the type of taxpayers (firm or household, personal or in rem); or by the market in which they are imposed (product or factor) (Ibid.). Musgrave and Musgrave (1989) also point out the distinction between the direct and indirect taxes. Direct taxes are defined as '[taxes] which are imposed initially on the individual or household that is meant to bear the burden' (Ibid., p. 215). The distinction between these taxes is that the burden of indirect taxes is meant to be shifted to the intended final bearer. An important characteristic of direct taxes is that they must be able to adjust to taxpayers' individual circumstances (Atkinson, 1977). Therefore, income taxes are normally classified as direct taxes and most in rem taxes (taxes levied on things) are classified as indirect taxes.

Policy choice between direct and indirect taxation has long been a topic of animated debate in the study of taxation. While contributions to the topic can be dated back to the work of Ramsey (1927), analysis of both forms of taxation was first seen in the optimal tax theory pioneered by Anthony Atkinson and Joseph Stiglitz. The Atkinson and Stiglitz (1976) theorem states that the extent to which indirect taxes can be employed depends on the restrictions on the type of income taxes that can be employed and the form of consumer preferences. The key limitation of this theorem is the difficulties in observing different characteristics of individuals. The use of surrogate characteristics in practice does not perfectly correlate with actual characteristics of individuals. It is claimed that if the government is able to choose a general income tax function where

the utility functions are separable between labour and all commodities, then there is no need for indirect taxes to be employed (Ibid.).

An optimal tax structure—the balance between direct and indirect taxes—may vary by a number of factors. Differential commodity taxation is necessary when individuals differ in several unobservable characteristics, e.g. endowments, productivity or tastes (Cremer et al., 2001), and when there is the presence of uncertainty of wage earning ability of individuals (Cremer and Gahvari, 1995). In principle, when the government is concerned solely with the efficiency of a tax and has no interest in distributional objectives, only the direct lump-sum tax can be employed (Atkinson and Stiglitz, 1976). However, it is argued that, in practice, the transparency of tax systems can be improved by employing both direct and indirect consumption taxes (Dahlby, 2003), and social welfare can be increased by a commodity tax with the presence of a non-linear income tax system, assuming that human capital accumulation is endogenous (Naito, 2004).

The employment of both direct and indirect taxes is common in most economies but the question of what the ratio between the two taxes should be remains uncertain. The selection of the ratio has various impact on the economy. The impact that is highly relevant to this study is that on income distribution. In their attempt to quantify the level of income inequality as a result of tax policy trade-offs, Martinez-Vasquez et al. (2011) found that a 10 percentage point increase in the direct to indirect tax ratio would, on average, reduce the Gini coefficient—an indicator of income inequality—by about one percentage point. However, the impact of the direct to indirect tax ratio adjustment on income inequality appears to be lower for developing countries because of their relatively smaller tax systems.

The study of Martinez-Vasquez et al. (2011) has, to some extent, confirmed the positive relationship between the progressivity change of direct income tax and income distribution (as measured by the Gini coefficient), as also observed by Li and Sarte (2004) and Weller (2007). This may seem to be consistent with the conventional belief that more progressive direct tax rates can help improve income inequality problems. Nonetheless, this runs counter to the Atkinson and Stiglitz (1976) theorem, which claims that:

> …the use of indirect taxation stems from a pursuit of distributional objectives. The extent to which indirect taxes are employed to this

> purpose—that is, purchases of different commodities are used as a screening device—depends on the form of consumer preferences and on the restrictions (if any) on the type of income taxation employed (Atkinson and Stiglitz, 1976, p. 74).

The Gini coefficient is in fact a measure based on income level and, in some cases, may have left the consumption side out of the equation. When measuring the level of income distribution, it is important to take into account spending levels, as these in particular form real income, which is a meaningful measure for the analysis of tax effects. In this regard, Duncan and Peter (2008) found that the impact of (national) income tax progressivity on real income is significantly smaller compared to that on gross and net income, as approximated by the consumption-based Gini coefficient. Their finding suggests that the analysis of tax policies should consider both income and spending sides. If we look at the economy from a broader view, it is equally important to consider certain major economic components such as production and investment.

2.2 Key Principles of Taxation

In his 1776 magnum opus, *An Inquiry into the Nature and Causes of the Wealth of Nations*, Adam Smith set out four canons of a good tax system: equity, certainty, convenience and efficiency (Smith, 1776, p. 825–826). First, an equitable tax system should allow taxpayers to contribute in proportion to their income. Second, certainty means that the amount of tax payable must be definite and not arbitrary. This is to avoid the impact of taxes on work incentives and corruption in the tax administration. Third, taxes should be levied at a time, and in a manner, that are convenient to taxpayers. Fourth, an efficient tax system is one that minimises collection costs. However, Smith's idea was predominantly based on wealth and consumption taxes as Britain had no income tax at the time he was writing.

The following sections discuss the two criteria for the evaluation of tax systems, equity and efficiency, which are the bedrock of the analysis in this study.

2.2.1 Equity

In an equitable tax system, each taxpayer should contribute his or her fair share to the costs of public goods, but agreement on the level of contributions is difficult to reach. In the analysis of equity, two strands of thought have emerged from the literature: the benefit and the ability to pay principle.

The Benefit principle

According to the benefit principle, an equitable tax system operates under the notion that taxpayers contribute in line with the benefits received from the state. Taxes are paid in return for public services provided by the government. In real estate markets, improvements in public services are reflected in higher prices of real properties, which should be paid by property owners (Musgrave and Musgrave, 1989). The equity of tax systems depends on expenditure structures. In most democratic countries, tax and expenditure policies are closely related. Fiscal policies that are not popular among voters are likely to be abolished. In this regard, the benefit tax may be considered a voluntary payment for public goods.

In terms of general benefit taxation, everyone should ideally be taxed according to his or her evaluation of demand for public goods. This concept treats the tax system like the market system in that income and price elasticity of demand for public goods

play a vital role in the analysis of a consumer's preference patterns. The general benefit taxation seems logical in principle but proves difficult in practice because it cannot be used in the case of pure public goods. The consumption of pure public goods—e.g. public parks, public libraries and street lights—is non-rival and non-excludable. Therefore, the magnitude of the benefits received by different individuals is impossible to identify (Stiglitz and Rosengard, 2015).

Some practical applications of the benefit principle can be found in cases where goods and services are provided using direct financing. There are two classic scenarios in which public goods can be provided on a benefit basis. One is a direct charge, such as an airport and car park charge, which is an appropriate revenue raising option when the characteristics of public goods provided are similar to those of private goods, of which consumption is rival and excludable. The other is a more general scenario in which the imposition of direct charges is impossible or too costly, meaning taxes may be used in lieu of charges, for example the use of gasoline taxes to finance roads.

For a benefit tax to become specific, many have argued that it should be earmarked and allocated to the government activities from which taxpayers directly benefit. Earmarking—or tax hypothecation—can exist independently from benefit taxation, and vice versa. As shown in Table 2.1, type A is clearly a strong form of earmarking in which the beneficiaries pay for the goods provided to them. This type of tax is possible to implement in cases where there are no or very few external benefits or costs. However, other forms of earmarking (types B, C and D) cannot be considered benefit taxation due to a tenuous connection between taxpayers and beneficiaries, especially for the taxes designed to redistribute income (Mccleary, 1991).

As pointed out by Musgrave and Musgrave (1989), redistributional objectives cannot be achieved by the application of the benefit approach. There is no clear separation between taxes that are used to finance public goods and taxes that are used to redistribute income. Some parts of the tax bill can be allocated to defray the cost of public services but other parts cannot perform such a function in practice.

Table 2.1 Varieties of earmarking

Type	Revenue	Expenditure	Examples
A	Specific tax or fee	Specific end use	Gasoline taxes and motor vehicle fees for highway investments.
			Social Security, unemployment funds.
			Support of public enterprises.
B	Specific tax or fee	Broad end use	Lottery proceeds and sin taxes (on tobacco and alcohol) to finance social sector programmes.
			Taxes and royalties from petroleum to finance development.
C	General tax	Specific end use	Fixed percentage of total revenue devoted to specific programmes (such as education).
			Revenue sharing for a specific purpose.
D	General tax	General end use	Revenue sharing.

Source: Mccleary (1991, p. 83)

The Ability to pay principle

In contrast to the benefit principle, the ability to pay principle considers tax collection as independent from expenditure determination. The ability to pay principle encompasses the redistribution function because it calls for people to contribute in line with their taxable capacity. Income is the most widely used measure of the ability to pay, and high-income earners are considered to have higher taxable capacity. They are thus not only required to pay a higher amount of tax but also a greater fraction of their income in taxes, reflected in progressive income tax rates. There are two dimensions of equity: horizontal and vertical.

Horizontal equity can be achieved when individuals who are similar in all relevant respects are treated equally by a tax system. In other words, the same level of tax burden should be distributed among individuals at the same level of taxable capacity. In practice, taxable capacity may be assessed by actual income level or stock of wealth, but difficulties arise when trying to estimate other capacities such as earning ability or personal circumstances. Individuals who have similar opportunity sets but make different choices of jobs or consumption may end up incurring different amounts of payable taxes. With consumption tax, some types of goods such as alcohol and luxury items attract a greater variety of taxes, with higher percentages.

Vertical equity can be achieved when individuals who have higher taxable capacity pay higher taxes than those who have less taxable capacity. In practice, however, there are at least three problems associated with this principle: (1) who should pay higher tax

rates; (2) how much higher the rates should be; and (3) how to design a tax system that can comprehensively implement this principle (Lymer and Oats, 2015). Suppose two persons, A and B, undertake the same job and earn exactly the same rate of pay. A chooses to work overtime while B chooses to spend more time on leisure activities. Is it fair if A has to pay more tax than B? Some might suggest that potential income is a fairer measure, but its determination has many practical difficulties and reliability issues.

The ability to pay principle can be applied to property tax as well. Either capital or rental values of properties are, to a certain extent, related to the ability to pay. Horizontal equity is compromised when properties with the same market value are treated differently. It could be that they have not been assessed in the same fashion (by different methods or by assessors whose judgments differ) or their assessments are prepared at different points in time. Failure to frequently update tax base—i.e. property assessed price used for tax calculation—is one of the main causes of inequity in property taxation.

When applying the concept of vertical equity to property taxation, owners of high-value properties are considered to have a higher ability to pay because they possess more wealth. For a tax system to be vertically equitable, tax rates must rise with property values (progressive). However, this concept is not quite fair for people who are ‘asset rich, cash poor’ such as pensioners who live in high-value housing with little income (see for example Policy Exchange, 2013). Therefore, on an income basis, using property wealth as a measure of ability to pay is still central to debates. However, this problem may be solved by properly designed tax reduction schemes. The concept of equity in property taxation will be discussed in detail in the following chapters.

2.2.2 Efficiency

In dealing with efficiency we now shift our focus from the effect of taxes on market prices to quantities. The concept of efficiency will not be discussed in detail in this thesis but it is necessary to mention some key ideas. There are two main aspects to efficiency: economic and administrative.

Economic efficiency

Many public finance theories are based on the assumption that agents fully optimise their decisions and perfectly react to tax policies in order to minimise tax burdens (see Atkinson and Stiglitz, 1976; Harberger, 1964; Mirrlees, 1971; Ramsey, 1927). As taxation is compulsory, the levying of a tax may affect decisions of individuals and firms who tend to change their behaviour to avoid tax. Such distortion as a result of taxation may sometimes be deliberately intended by a government to control certain activities. For example, tobacco and alcohol duties (sin taxes) are used to restrict their consumptions and to finance public healthcare systems.

The negative impact of taxation on economic activities is known as excess burden or deadweight loss. It is caused by inefficient consumption and production by individuals or firms. The degree to which economic efficiency is reduced depends on the elasticity of demand and supply for a particular good (Gruber, 2013). When either demand or supply is elastic, the quantity of goods being exchanged varies more with price. The more elastic the demand or supply for a good is, the larger the deadweight loss is. Tax decreases demand as buyers have to pay more, and it also decreases supply as producers gain less. This is because parts of consumer's and producer's surplus become tax revenue, and the rest becomes deadweight loss.

Tax rate is another factor that affects the size of deadweight loss, which, assuming the supply of land is inelastic, seems particularly relevant to property taxation. The demand and supply schedules shown in Figure 2.1 (a and b) illustrate two different cases of tax collection in which one has a higher tax rate than another. Assuming there are two markets, A and B, which are identical in terms of demand and supply elasticities, but the tax rate in market A is higher than that in market B. Before tax collection, the equilibrium price and quantity are at P_0 and Q_0, which are the same in both markets. After collecting the tax, the product price in market A increases higher (from P_0 to P_b) than market B, and the quantity of the goods in market A reduces more than market B (from Q_0 to Q_1). It can be seen that, in market A, both consumers and producers are liable to higher tax burdens compared to those in market B. This results in higher deadweight loss in market A (the highlighted area), as the price that consumers have to pay (P_b) is higher and the price that producers receive is lower (P_s), as compared to market B.

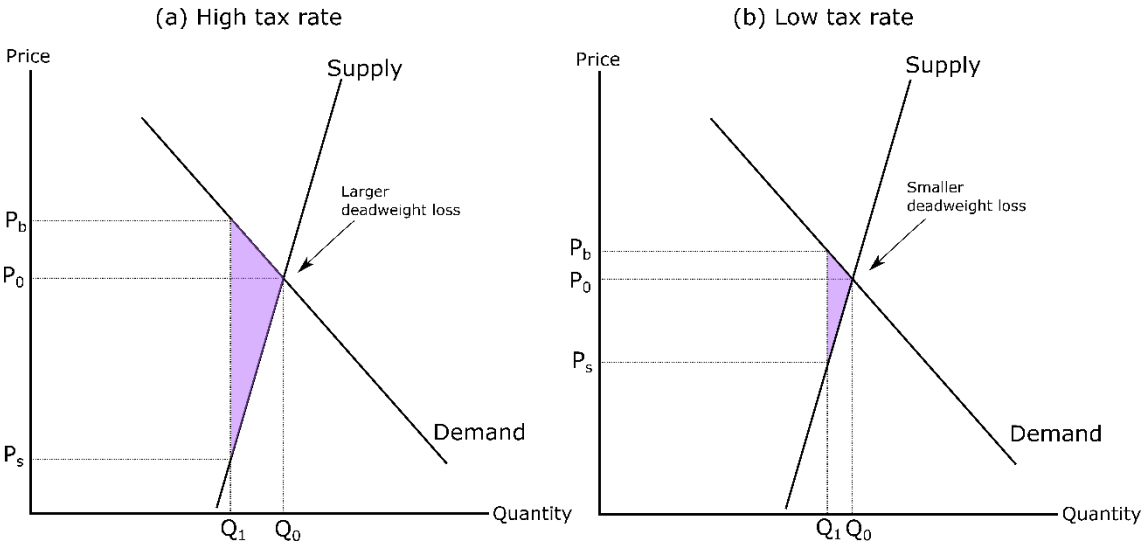

Figure 2.1 Effects of tax rate on deadweight loss

Administrative efficiency

Another determinant of a good tax system is the cost of taxation, which can be divided into three main categories: distortion cost, administrative cost and compliance cost. As mentioned earlier, distortion costs refer to the extent to which taxpayers' decisions are distorted by taxes. The risk exposure cost of tax evasion can be regarded as a type of distortion costs, and it varies by how much each individual is concerned about the risk (Mirrlees et al., 2010).

Administrative costs are borne by the public sector in the management of tax systems. The costs are incurred by tax authorities in their effort to minimise non-compliance with tax collections. In property tax systems, for example, the administrative costs are incurred in the form of the money allocated for property assessment and appeal processes. Compliance costs, on the other hand, are borne by taxpayers, which arise when complying with tax obligations and also when attempting to avoid or reduce tax liabilities. The more time and money needed in conforming with tax requirements, the less efficient tax systems are.

The next section reviews fundamental theories in urban economics. A particular focus is placed on the workings of the housing market vis-à-vis key economic factors.

2.3 Land Use Theory

In this section we will turn to some key urban economic theories to help us better understand housing processes and outcomes. There are two key strands of research in urban economics (Carter, 1995). The first strand includes works on urban hierarchies primarily based on Walter Christaller's central place theory (Christaller, 1966), and the other concerns works on urban land use such as Homer Hoyt's sector model (Hoyt, 1939) and William Alonso's bid-rent theory (Alonso, 1964). In this thesis, we employ the latter strand of research as our analytical framework. Each important land use theory will be considered in chronological order.

The most influential early land use theories are those of Ricardo (1821) and von Thünen (1826). The Ricardian theory is based on fixed supply of land and differential fertility of agricultural land. The starting point is that in relatively small populations, only the lands with greatest fertility are cultivated—i.e. lands that are most fertile and closest to the market. When population grows, the diminishing returns on existing lands force cultivation of inferior 'marginal' lands, which, given the same amount of capital invested, produce lower yields. The cultivation of marginal lands continues until it reaches the point where there is no surplus from the production (total costs equals total sales revenue).

Land rent[3] arises from the indestructible quality and locational scarcity of land. It varies according to the productive power of each plot of land. Lands with greater fertility earn higher rent, which equals the difference between the value of the produce of the superior lands and that of the inferior lands, assuming that the cost of production for all grades of lands are the same and lands are cultivated in descending order in terms of grades. Rent increases with additional units of capital applied to cultivate marginal lands at a diminishing return. Improvement in transport facilities/means can lead to a fall in transportation cost and thus a fall in rent. It is because the transportation cost is part of the production cost, that marginal lands tend to gain higher profits from a reduction in transportation cost, resulting in a decrease in differential rent. Ricardo believes that rent does not enter into price. Rather, price is determined solely by the demand for such produce and the availability of fertile lands.

[3] Ricardo (1821, p. 39) defines rent as 'the portion of the produce of the earth, which is paid to the landlord for the use of the original and indestructible powers of the soil'.

However, Ricardo's concept of rent has been the subject of several criticisms. First, assuming the demand for agricultural produce is stationary, improvement in fertility of marginal lands (e.g. as a result of improved methods of cultivation) can lead to a fall in rent. Land fertility is not fixed. Producing capacity varies according to locations and it can be improved, for example, by incorporating cover crops and compost. Conversely, fertility can be exhausted through unrestricted cultivation. Second, the relationship between rent and price asserted in Ricardo's theory only holds when land is devoted to a single use. In real conditions where lands are adapted to some other use, the rent that it could have yielded is now part of the cost of production, and it must enter into the price of such a product (Mill, 1885). In other words, the rent foregone is an opportunity cost, which must be debited in the new production, and thus becomes price-determining (Hyde, 1898). Therefore, not only is rent determined by the market price of produce but also vice versa.

Von Thünen's location theory involves spatial simplification of a concentric agricultural land use (von Thünen, 2009 [1826]). In the theory, land is homogenous in all respects and land rent is based on distance from the market (town). In the 'isolated state', a single marketplace is surrounded by farmland. It is self-sufficient and is free from external influences. The city's economy is set up into what he identifies as the 'four rings' of agricultural activity, based on land rent and transportation cost. Type of land use depends on transportation cost, which is directly related to distance. The first zone located closest to the city centre is where dairying and intensive farming take place because these produces require quick transportation to the market. The second zone is the location for energy products such as timber and firewood. Their production needs to be located as close to the city as possible because of the difficulty of transportation. The third zone is where farmers grow extensive field crops such as grains, which can last longer and are cheaper to transport. The fourth zone is the location for ranching as this activity involves the least intensive land use and the cheapest transportation cost.

The core concept of von Thünen's model is a trade-off between land rent and transport cost (O'Kelly and Bryan, 1996). Land rent is the function of yield from agricultural products, market price, production costs, transport costs and distance from the market. It is greatest in the first zone and it decreases with distance away from the market. Rent gradience will eventually reach zero for the land in use at the greatest

distance from the market. From these underlying assumptions it seems that von Thünen neglects the fact that each location in space differs in characteristics—e.g. soil quality, irrigation, etc. But, like most location theorists do, he emphasises the importance of transport-cost differential over space (Fujita and Thisse, 2013). Despite the simplicity of the model, it lays a firm foundation for later theories of land use in contemporary contexts such as Isard (1972 [1956]), Alonso (1960, 1964) and Beckmann (1969). These theories reinterpreted von Thünen's town as the city centre or central business district (CBD) and adapted its concepts to urban land use.

Alonso extended von Thünen's model to various types of land use (housing, commercial and industrial), giving land use, rent, intensity of land use, population and employment as a function of distance to the CBD. His 'bid-rent' model is based on a monocentric form of a simplified city, in which a single-mode transportation is possible in all directions and the city centre is the only marketplace for all goods and services. The city also has uniform tax rates, and there are no institutional restrictions on land transactions, with perfect knowledge of land prices at every location (Alonso, 1960). The model seeks to explain the interaction between price and demand for land in terms of distance from the CBD. He begins the model with a budget constraint function faced by an individual, which includes the price and quantity of the composite good and land, and the monetary cost of commuting subject to distance from the centre. The budget constraint function can be expressed as:

$$y = p_z z + P(t)q + k(t) \tag{2.1}$$

where y is income; p_z is the price of the composite good z; $P(t)$ is the price of land; q is the quantity of land; t is the distance from the centre of the city; and $k(t)$ is the monetary cost of commuting from distance t to the centre of the city.

It is also assumed that the utility is maximised subject to the budget constraint, which is the function of the quantity of composite good, land and distance. As opposed to composite good and land, the model treats the distance from the centre as a good with negative utility. The utility function can be expressed as:

$$u = u(z, q, t) \tag{2.2}$$

The most significant contribution of Alonso's model is the inclusion of the choice of location as part of the consumer choice. The equilibrium condition for an individual's choice of location can be expressed as:

$$q\left(\frac{dP}{dt}\right) = \left[\left(\frac{u_t}{u_z}\right) - \left(\frac{dk}{dt}\right)\right] \tag{2.3}$$

where u_t is the partial derivative of the utility function with respect to the distance from the centre of the city (t); and u_z is the partial derivative of the utility function with respect to the composite good (z). And $u_t/\ u_z$, in Alonso's terms, is the marginal cost of spatial movement, which equals:

$$\frac{u_t}{u_z} = \frac{\left[\left(\frac{qdP}{d}\right) + \left(\frac{dk}{dt}\right)\right]}{p_z} \tag{2.4}$$

From Equation 2.4, it can be seen that, for an individual to be in equilibrium, the price of land must decline with distance to the city centre. This is a notable piece of deductive reasoning by Alonso. As distance increases, the change in the amount paid for land equals the additional cost of distance, which has two main components: the monetary cost of distance and the monetary value of its marginal disutility (McDonald, 2007). Therefore, the marginal benefit must equal the marginal cost in order to maintain the equilibrium. Deriving from the equation, the slope of the residential bid rent curve for individual *i* at some level of utility is:

$$\frac{dp_i}{dt} = \frac{\left[\left(\frac{u_t}{u_z}\right)_i - \left(\frac{dk}{dt}\right)\right]}{q} \tag{2.5}$$

Alonso is particularly interested in the effects of income, population growth and improvements in transportation on the residential land market. An increase in income will increase q as land is a normal good (Equation 2.5). This results in a flatter residential bid rent function. However, the larger income will also increase the monetary value of the disutility of an increase in distance $(u_t/u_z)_i$, which makes the bid rent function steeper. From these observations, it can be concluded that there is a negative relationship between price (rent) and distance from the centre, and that income has a positive effect and distance has a negative effect on the amount spent on land (pq) (Alonso, 1964; McDonald, 2007). Consumer choice is hence based on the balance between land and commuting costs, which is the underlying reason for residential location.

Alonso's model was extended by Richard Muth, who continued to assume a monocentric form of city. He is particularly interested in the effects of changing market

conditions on equilibrium land uses and rents. Based on assumptions of a featureless urban plain, Muth (1961a) constructed a model consisting of two firms of competitive industries, one providing housing services and the other agricultural commodities. Production inputs of both firms are land and labour, and their production functions are identical and are logarithmically linear as are their demand functions. The prices of production output and housing services decline exponentially with distance from the centre of the city. This is because transport costs and time increase at a decreasing rate with distance from the city centre. Traffic in areas near the centre of the city generally moves more slowly than in areas farther away. When the demand for housing increases, the city limits move outward, which results in the increase in the price of agricultural product as its supply decreases. This implies that both commodities are related.

In his second article, Muth did not pursue the empirical testing of urban-rural boundaries but moved his attention towards the study of urban population densities, in which he constructed population density functions for forty-six US cities (Muth, 1961b). Based on the model in his previous study, he further assumes that the elasticity of demand for housing is a constant, given that the real income per-capita is constant. In Muth's scenario, an individual's saving on housing costs from the change in distance (away from the city centre) equals the change in transport costs. This is similar to the consumer equilibrium condition proposed by Alonso. Given that all households are identical, no matter where their locations are, they must be on the same indifference curve in equilibrium. Muth states that the per-capita consumption of housing increases with distance, and its level varies by the price elasticity of demand for housing and the change in the housing price per unit of distance. Based on Muth's equilibrium, subsequent studies confirm that the observation of inelastic income-constant demand is valid (*inter alia*, Brueckner, 1982; Kim and Mcdonald, 1987; McDonald, 2007). Muth (1961b) finally concludes that the gradients of his population density functions become flatter as car registrations and the proportion of poor condition central city settlements increase, and become steeper as the proportion of manufacturing employment in the city centre increases.

Edwin Mills is another economist who is interested in the effects of production and income on the sizes and structures of urban areas. In his early work, Mills (1967) constructed a model assuming that land is homogenous and that all production functions have constant returns to scale. There are only three activities taking place in

the urban area: production of goods, intracity transportation and designated housing. As in the models described above, Mills assumes a monocentric urban form. The endogenous variables in the model are input and output quantities and prices in the three activities, the land rent and the distribution of residences. The exogenous variables are the parameters of the three production functions, parameter of the demand function for goods, prices of labour and capital, the fraction of the labour force employed in the suburbs, the demand for housing per worker, and the rental value of land for agricultural purposes (Mills, 1967, p. 206). There are two distance variables in the model: one is the distance from the centre to the boundary at CBD (k_0) and the other is the distance from the centre to the outer edge of the suburbs (k_1).

In essence, the model explains the changes in size and spatial organisation of urban areas by deriving land use functions for goods production, transportation and housing. The total amount of land available increases proportionately to the distance from the centre of the city, but the amount of land available for goods production grows at a decreasing rate with distance from the city. The reason is that the growth in the amount of land needed for transportation at distance *u* from the centre of the city is proportionate to the number of workers resident at distance *u*, which increases at a faster rate than *u*. This leads to the problem of traffic congestion, which Mills (1967) claims is not inherent in large cities. Congestion comes about because the adjustment of the number of workers and the amount of capital per the amount of land used in goods production is quicker than the transfer of land used for production to that used for transportation. This is consistent with the fact that, for example, the transfer of CBD land through land appropriation process from goods production use (by the private sector) to transportation use (by the public sector) takes longer than the transfer of land within the private sector.

In later works, Mills (1972) continues to employ a constant-returns-to-scale Cobb-Douglas production function, in which land and capital are used as inputs. In this model, the price of capital is exogenous (the same at each distance from the CBD) while land and housing prices are endogenous (varying with distance from the CBD). In equilibrium, the functions of land rents, housing prices and population density follow the exponential form, and the population density is zero at the edge of the urban area. There are two main implications of the model. First, the gradient of the population density function tends to become smaller as income increases. An increase in income

would increase demand for housing, encouraging people to move farther from the CBD. Second, when there are improvements in transportation (lower costs and faster commuting time) the gradient of population density function would become smaller. This is due to an increase in transportation to obtain cheaper housing. Thus, both changes in income and transportation technology have similar effects on the slope of population density function. With some modifications to the model, Mills and Tan (1980) found that density gradients for a number of developed and developing countries have flattened over long time periods (between 1950 and 1970), which is similar to the results of American suburbanisation observed by Mills (1972).

On the topic of the spatial pattern of residential land use in cities, Muth (1969) argues that the output of housing per unit of land and population density would grow more rapidly in the suburbs as the demand for housing increases, given the substitution elasticity of land for housing is less than one. He also states that the decline in housing value per unit of land results in the decline in population density with distance away from the CBD. But why, in reality, do cities not become decentralised to the extent that the model anticipated? A possible reason is that marginal transport costs, particularly in large cities, are higher due to greater traffic congestion (Muth, 1971). Applying Mills' (1972) theoretical framework, McDonald (1979) found that, in 1970, population density in Chicago was affected by income and household size, but not by land value. Land value only has influence on newly constructed buildings.

The Muth-Mills model was extended by LeRoy and Sonstelie (1983) by allowing for additional modes of transportation: fast and slow. The fast mode is automobile and the slow mode is walking. It is assumed that households of different income base their choices on different sources of benefit. The rich consume more housing and value their time more than the poor. The introduction of the automobile as a fast mode of transport gives first access to the rich to live further out in suburban locations because they are at a comparative advantage. But as the automobile becomes more affordable, the poor increasingly suburbanise, which finally causes the rich to be at a comparative disadvantage. This results in the rich moving back to the CBD, generating the reversal of residential patterns as well as the process of gentrification. According to the model, it can be concluded that an increase in the costs associated with car commuting tend to discourage gentrification as income elasticity of the marginal cost of car commuting becomes more inelastic.

Critics of the Muth-Mills model often accuse it of being overly simplistic and not representative of the real world. For example, many cities are no longer monocentric, and employment is located farther from the old city centre (Glaeser and Kahn, 2001). Couch (1980) contends that Muth's (1961b, 1969) models do not sufficiently demonstrate how an increase in population can reduce the gradient of population density function. He proposes the base-price model, which allows the consumer to purchase a range of non-housing goods at different locations as an alternative to Muth's models. It is suggested that costs of travelling to work should be treated as one good among many non-housing goods. However, these criticisms miss the point that the model's simplicity is what makes it so widely applicable. Some basic predictions of the Muth-Mills model such as that the city size is determined by a market-driven allocation of land use (rather than by uncontrolled sprawl) have been proved by Brueckner and Fansler (1983) to be valid. Omissions in the Muth-Mills model that seem to be a flaw, such as the lack of employment sub-centres, have in fact made the model very versatile (Spivey, 2008).

Several policy implications can be drawn from the theories that have been reviewed in this section. Much evidence and analysis indicate that the demand for housing is induced by changes in technology and income, and that population density is affected by these factors, as is household size. It can be said that suburbanisation is largely the result of market allocation. There are also implications for urban problems such as traffic congestion, which can be ameliorated with urban policies that are suitable to urban forms and land use patterns. The policies should be formulated in a way that can accommodate such market-driven demands, and that can keep a balance of infrastructure development funds allocation between several modes of transport and between urban and suburban areas (Mieszkowski and Mills, 1993). Housing policies should be formulated in accordance with the structure of urban transportation systems and policymakers should be aware of the commuting demands of residents. The priority should be to minimise time and money costs of commuters, which some analysts estimate to be about equal (Mills, 2004).

In the following section the concept of urban geography will be introduced. The literature has established a fundamental link between processes of urban development and economic changes. Economic forces are often regarded as the dominant influence on urban changes, and vice versa (Pacione, 2009). The globalisation of production,

consumption and exchange relations has transformed trade between nation states into a global economy (Hall and Barrett, 2018), which has placed urban studies at the centre of economic and tax policy debates. The section will then move on to debates around spatial justice and contemporary urban problems.

2.4 The Formulation of Urban Forms

Urban form can be defined as 'the spatial configuration of fixed elements within a metropolitan region' (Anderson *et al.*, 1996, p. 9). In general terms, urban form can be considered from two perspectives: density and diversity. Density refers to the degree of activity within a particular space, while diversity measures the spatial scale at which different land uses interact (Cervero and Kockelman, 1997; Tsai, 2005). There are three types of archetypal urban forms that are often referred to: concentric, radial and multinucleated. In the concentric city, the CBD is the location with highest employment density, number of trip ends and rent (Anderson et al., 1996). Land uses are segregated around the CBD according to the maximisation of accessibility value. Radial cities have fewer major transport routes than concentric cities, resulting in areas of sparse development between transport lines. Multinucleated city has a more complex, hierarchical transport system, which means that not all transport lines are oriented towards the CBD. There are three common levels from which urban form can be viewed: metropolitan area, city and neighbourhood. The classification is crucial because some urban form variables only operate at certain levels, while some variables may carry different meanings and affect social activities differently when operated at different levels (Tsai, 2005).

Spatial structure is a more comprehensive concept, which can be defined as the overall shape of a city, and is comprised of three elements: urban form, urban interactions, and a set of organising principles between the two (Bourne, 1982). Urban form has an influence on the flow of goods, people and information within a city but does not necessarily determine them. In his 1960 book, *The Image of the City*, Kevin Lynch makes a connection between environment and psychology by raising the notion of legibility, which refers to the extent to which the cityscape is read by people who move through the city and engage in the process of way-finding. He proposes five elements: paths, edges, regions, nodes, and landmarks. Paths are the channels of movement people use to move throughout the city. Identity, continuity and directional quality are the three characteristics of any path. Edges are boundaries and linear breaks in continuity such as railroad cuts and shores. Regions are areas characterised by common characteristics and have separate visual identities from the rest of the environment. Nodes are strategic foci for orientation or gathering points like plazas and

junctions. They perform as the convergence of paths. Landmarks are external points of orientation, which may vary with individuals' personal experiences (see Lynch, 1960).

Contemporary urban forms have been created by the interaction of economic, cultural and political factors (Fainstein and Campbell, 2011). Difference between urban forms are amplified by social and cultural dissimilarities, which create variation in socio-spatial patterns. The spatial difference between North America and Europe is a good example. While the designers of European cities tend to value communality and place a higher premium on collectively enjoyed spaces, their American counterparts often emphasise privatism, for example, opting strongly for gated communities (Ibid.). Even though advances in transport technology have made it possible for workers to live farther from their workplaces, the degree of spatial deconcentration also depends on the stringency of regulation and the tastes of consumers (Fainstein and Campbell, 2011). This can be seen in the sharp boundaries of large-scale suburbanisation in the UK that result from the greenbelt policy. Compared to North America, there is generally less rigid spatial segregation by income in Europe (Musterd and Ostendorf, 1998). This is characterised by predominantly attached housing in most European cities.

Countries outside the nations that had dominated the world economy during the twentieth century seem to have greater dissimilarities in terms of the level of economic development, cultural diversity and political regimes; and these are reflected in the diverse range of urban forms (as well as the ways in which land is evaluated). These countries include newly industrialised countries (NICs) such as Brazil and China, extremely poor countries in Africa, oil-rich Middle Eastern nations and some recently developed countries in Asia. Gugler (1996) identifies three generalisations about urban form within these countries. First, many cities have experienced rural-urban migration. Cities with low levels of economic development are described as demonstrating urbanisation without industrialisation. Second, post-colonial cities can be identified by a division between the planned area previously occupied by colonial officers and business owners (and now the home of the elite) and the larger unplanned area. Third, a variety of different urban forms are found in the NICs, ranging from modern skyscrapers cities like Taipei and Seoul to mixed conurbations like Bangkok and Mumbai where informal settlements can be found beside luxury and middle-class dwellings.

The contemporary world has been governed largely by hypermobility and global communications, resulting in dynamic processes of centralisation and dispersal that have taken place across national and regional boundaries, rather than being confined within them. Globalisation has reshaped the economic geography of many cities. Production has become more specialised as investment continually flows towards places with lower labour costs and greater advantages—e.g. relaxed financial regulations. Big transnational corporations with high levels of competitiveness have benefited from globalisation the most as they have gained access to new production sites and made use of resources at lower costs.

Fainstein and Campbell (2011) describe three broad types of industrialised cities that are the outcome of the globalisation processes: declining industrial centres, global cities, and expanding and contracting regions. Declining industrial centres result from the displacement of mature industries due to competition from other countries. Global cities are cosmopolitan and have control over the world financial system (Sassen, 2011). London, New York and Tokyo are good examples of premiere global cities. Expanding and contracting regions are characterised by simultaneous growth and decline within a country or a metropolitan area. Expansion is usually experienced by cities with good business climate while contracting cities normally have obsolete industrial structure and socio-political system (Fainstein and Campbell, 2011). The three types of cities have different influences on the housing market as the structure of labour and employment differs. In London, for example, Hamnett (2003) argues that the nature of the housing market has been affected by changes in industrial, occupational and earning structure. Given the change in housing demand and supply, there is a growing social polarisation between housing tenures.

Associated with globalisation is the upsurge in the popularity of neoliberalist ideology which advocates individualism, market liberalisation and contraction of the state. During the post-war era the world had been governed mainly by the Keynesian economic policy regime characterised by the interventionist models. However, between the late 1960s and early 1990s, theorists found it increasingly difficult to remain technocratic, and policy makers faced more challenges in mediating the growing conflicts between different interest groups (Chang and Rowthorn, 1995). For the less developed countries (LDCs) including Thailand, the transition began later than the

advanced economies, that is, in the 1980s with pressure from the Bretton Woods institutions—i.e. the World Bank and the IMF.

The neoliberals argue against interventionist policies such as subsidisation and tax credit targeting, and thus favour market liberalisation and depoliticisation of the economy. Within the neoliberal literature, the Keynesian political regime is regarded as undemocratic, characterised by the top-down, national-scale policymaking that places intense restrictions on local authorities (Harvey, 2005). Neoliberals claim that devolution and outsourcing empower localities to make collaborative decisions within the local context. Devolution, in this regard, can be justified by the democratisation of the decision-making process (Mayer, 2007).

Nonetheless, Purcell (2006) raises the issue of the local trap—the tendency to assume that the local scale is inherently more democratic than other non-local scales—to argue that neither devolution nor outsourcing is in itself necessarily a move towards greater democracy. He attacks the assumption of the urban democracy literature (*inter alia*, Berry et al., 1993; Fung, 2006) that 'the more autonomy local people have over their local urban area, the more democratic and just decisions about the space will be' (Purcell, 2006, p. 1925). From the scale theory perspective, he asserts that the need for cities to remain globally competitive increasingly dictates urban policy decisions and, as a result, urban governing institutions have become less democratic as they have gone through restructuring processes to better respond to the needs of capital (Ibid.).

In fact, neoliberal support for devolution and deregulation does not necessarily accommodate the making of a just city. As suggested by Florida (2018), land use deregulation alone is not enough for the promotion of economic and social benefits within the city. Extreme land use deregulation policy would create a version of gentrification, increasing the costs of urban lands and driving the growth of luxury high-rise construction. He claims that land value taxation (LVT) would help tackle the problem of higher land costs through the stimulation of higher-density land use; and investment in public transport infrastructure needs to catch up with the increasing density and growth to avoid significant increases in property prices around transport hubs (Ibid.).

2.5 Spatialising Justice

In *A Theory of Justice* (1971), John Rawls seeks a neutral standpoint from which he claims that, under given circumstances, the ideal level of justice is reached when the prospects of the least fortunate are as great as they can be. His egalitarian position supports the fair distribution of liberty, opportunity, wealth and self-respect. The evaluation of fairness should be carried out from behind the 'veil of ignorance', where individuals are unaware of their status in a society and act fairly in formulating essential elements of a just society. In other words, an ideal justice can only be established when there is an absence of the circumstances within which it is considered. He of course cannot presume total ignorance but rather assumes that we are logical in applying the general laws of human psychology and economic behaviour, reflecting the universality of his theory—as it does not matter where and when it is applied. Rawls' theory of distributive justice has been criticised for emphasising on static forms of social inequality, leaving the processes by which unfair outcomes are produced (Harvey and Potter, 2009).

On the contrary, David Harvey shifts attention towards social processes and their relation to the concepts of rights and justice. His early volume, *Social Justice and the City* (1973), could be marked as the beginning of a geographical approach in justice studies. He creatively expands the concept of territorial justice first coined by Davies (1968) and claims that it can be achieved if:

> (1) The distribution of income should be such that: (a) the needs of the population within each territory are met, (b) resources are so allocated to maximize interterritorial multiplier effects, and (c) extra resources are allocated to help overcome special difficulties stemming from the physical and social environment.
>
> (2) The mechanisms (institutional, organizational, political and economic) should be such that the prospects of the least advantaged territory are as great as they possibly can be (Harvey, 1973, p. 116).

In addition, Harvey identifies the relationship between urban space, social justice and urbanism. In fact, the crucial point in Harvey's study is similar to that of Castells', which essentially relates to the ways in which power structures affect urban outcome and thus reinforce justice. However, Harvey openly discusses the logic of capital as it

circulates through the financial and property sectors, and how it leads to crises of accumulation. As a result of globalisation that causes cities to grow very rapidly, there has been ‘a significant reorganisation in the location and distribution of various activities in the city system’ (Harvey, 1973, p. 61). The shift of investment across spatial boundaries implies a changing location of economic activity, which means a changing location of job opportunities as well. He describes this phenomenon as the ‘spatial fix’. In this regard, injustice arises from rapid disinvestment and impoverishment, and of course there are social costs of insecurity and changing relations between producers and consumers (Fainstein and Markusen, 1993).

Similar to Harvey, Soja (2010) argues that inequitable social relations and societal development are caused by unjust urban geography. Spatial injustice must be tackled by gaining control over the processes that produce spatial inequity. Coalitions of disadvantaged groups demanding the right to the city are the means for achieving more equitable geography. Accordingly, it is assumed that the involvement of disadvantaged groups in policy decisions would yield greater distributive outcomes. This is known as ‘communicative rationality’ and is sometimes referred to as the collaborative approach (see Healey, 2006; Innes, 1995).

In *Justice and the Politics of Difference*, Young (1990) deviates from a fixation on distributive justice to emphasises the structural forces that create inequalities. She argues against the traditional concepts of homogenous communities of identity and instead supports pluralism and the heterogenous mixing of social groups. In this regard, she claims that justice can be conceptualised as the absence of forms of domination—i.e. marginalisation, exploitation, powerlessness, cultural imperialism and violence (Young, 2000).

Many geographers use the term ‘uneven development’ to describe the way in which capital flowing in and out of spatial boundaries (e.g. city, region, country) constantly creates relative poverty and wealth (Smith, 1991). The argument supporting this theory has two main dimensions: the production of spatial scales and the production of geographical difference (Harvey, 2011). Spatial scale matters because, within a nested hierarchy, what makes sense at one scale does not necessarily register at another. Spatial scales are constantly redefined, contested and restructured (Swyngedouw, 1997). Geographical differences have been aggravated by volatile changes resulting from globalisation. The differences are ‘being reproduced, sustained, undermined, and

reconfigured by political-economic and socio-ecological processes…' (Harvey, 2011, p. 361).

From the planning point of view, Fainstein (2010) asserts that there is often a conflict between equity, diversity and democracy. Among these values, she gives priority to equity, which can be achieved through certain policies that focus on disadvantaged groups—as defined by income or marginality. Central to her idea are the policies that promote accessibility (through the reduction of intra-urban transportation fares) and democracy (which allows disadvantaged groups to not only participate but also to be included in decision-making processes). Like Young (2000), Fainstein supports neighbourhood homogeneity and the recognition of difference. Fainstein's view is opposed to that of Harvey and Potter (2009), as she is willing to embrace reform through existing systems rather than considering justice as unattainable under the regime of capitalism in which the process of capital accumulation prevails.

Marxist Geographical Perspectives

Since the late 1960s, western Marxist theory has been broadened beyond simple terms of labour-capital relations. Many cities have experienced the development of various radical movements, which posed new problems. Much of the discussion about spatial justice is based on the theoretical basis developed by two Marxist theorists—Henri Lefebvre and Manuel Castells. Lefebvre defines the city as being constituted by social relations rather than being merely a space or physical territory that contains buildings and population. The city became a constituent of the relations of consumption, production and reproduction. He claims that: 'The urban (space and landscape) remains unseen. We still don't see it. Is it simply that our eye has been shaped (misshaped) by the earlier landscape so it can no longer see a new space?' (Lefebvre, 1970, p. 29). Space is a social product infused with the logic of capitalism (such as profit-oriented production and labour exploitation). Capitalism has transformed space into a commodity in terms of its production (Lefebvre, 1977).

Furthermore, Lefebvre proposes the concept of 'the right to the city' based on his proposition of the contract of citizenship (*inter alia,* Lefebvre, 1991, 1996). Modern citizenship appears in the form of a contract between the state and the residents. He asserts that the contract has to be radically extended and deepened in order to articulate a new set of rights that better serve the needs of residents. With capitalism, space is

divided into isolated segments by the private property system, which can be compared to the division of labour. Therefore, the right to the city is seen as a struggle to de-alienate urban space by allowing inhabitants to appropriate space as they see fit. Such a process seems to require a revolutionary imagination of utopia comprising the persistent acts of resistance and creation.

Unlike orthodox Marxist theory, Castells regards the city as the site of social reproduction rather than the mode of production. He criticises existing theories (including Lefebvre's) as incapable of sustaining scientific analysis because they merely elaborate the ideological forms of capitalist society. Emphasising on the functional aspect of urbanist ideologies, Castells argues that urban systems involve collective consumption as a means of reproduction process, which is specific to spatial units (Castells, 1977). Cities are the place in which residents can use their labour to acquire collective goods to make up for their deficiencies. Castells rests his argument on social movements as the principle force for change within the context of structuralist theory rather than social classes or political parties. Underlying his argument is the theory of grass roots movements in which labourers struggle for improved collective consumption, cultural expression and political self-determination (Castells, 1983). While the city's role in production is minimised, the role of social movements is highlighted as having the potential to achieve transformative outcomes.

2.6 Contemporary Urban Problems

Since the early 1980s, we have seen the emergence of the shrinking middle class problem in many global cities (Kuttner, 1983). The major cause is claimed to be the combination of deindustrialisation and the shift to the service sectors, leading to the polarisation of the occupational class structure between highly skilled professional and managerial workers at the top and unskilled service workers at the bottom (Noyelle, 1983). The changing employment structure has spurred growing clusters of particular occupations within cities and the growth of these clusters has taken place at the expense of unskilled manufacturing class employment.

Friedmann and Wolff (1982) identify three types of clusters that have emerged in world cities—metropolises with certain levels of economic (and perhaps political) power such as New York, Tokyo, Sao Paolo and Bangkok. The first type is the cluster of business services which employ highly skilled, transnational elites and ancillary staff. The second type of cluster tends to serve the first, which consists of real estate and construction activities, restaurants, hotels, shops and personal and domestic services. The last type of cluster is similar to the second one but focuses more on the tourism industry. The inevitable impact of this spatial shift in the employment structure are the changes in economic and social composition.

Polarisation is a form of inequality that has arisen from the change in the organisation of work, which leads to the shift in the job supply and income structure. Sassen (1991) claims that the vast supply in low-paid jobs required by high-income professionals and the downgrading of the manufacturing sector are the two main developments in global cities that have contributed to economic polarisation. Sassen uses the term ‘new class alignment’ to describe the growth of high- and low-income strata of workers (Sassen, 1991, p. 13). The changing socio-economic structure of global cities has been the major culprit in the gentrification and residential segregation problems.

Gentrification is one of many pressing urban issues in today’s world. It can be broadly defined as ‘the transformation of a working class or vacant area of the central city into middle-class residential and/or commercial use’ (Lees et al., 2008, p. xv). The term was coined by Ruth Glass back in 1964 to describe the transformation of working class neighbourhoods in London—e.g. Notting Hill, Camden Town and Islington—into

residential areas where more affluent and educated people increasingly prefer to move in. In fact, the term was coined to signify the worrying trend, as Glass mentions in her essay: '…[London] may soon be faced with an *embarrass de richesse* in her central area—and this will prove to be a problem, too' (Glass, 1964, p. 141).

In the 1960s and 1970s, gentrification occurred through the moving of affluent and educated people to formerly upmarket neighbourhoods and the moving of artists and creatives to formerly industrial districts. Gentrification has largely been driven by back-to-the-city movement of young educated people, particularly in big cities in the US and the UK (Florida, 2018). Gentrification of this kind has been driven by large-scale public and private investments, which make amenities in the cities more attractive to gentrifiers than the suburbs. There were also significant changes in lifestyle of these young people who, in Gregory Lipton's words, 'decrease the relative desirability of single-family, suburban homes' (Lipton, 1977, p. 146). They tended to have postponed marriage and have fewer children as they live in a new dream defined in urban terms. Another explanation is that the rehabilitation of inner-city buildings was seen to be more economically viable (Smith, 1979). The costs of purchasing (and renovating) old but structurally sound properties in cities were less than the costs of new houses in suburbs and commuting to work.

The housing market and social geography have of course been reshaped by the gentrification process, which is taken to have more negative outcomes for the lower-income group (Hamnett, 2003). One of the most pressing problems is displacement, which implies disadvantages for lower income households in their right to the city. This phenomenon can be clearly depicted by Harvey's (1973) analogy of a theatre where the seats are allocated by the ability to pay. The highest income group has priority to choose the best seats, and the last group to choose is the low-income households who are left with uncomfortable seats and restricted views. One of the driving forces behind displacement is rising housing prices/rents. The outflow of the less advantaged people is troubling and likely to cause growing inequality as they are pushed out of the urban core where better job opportunities and amenities are located.

Gentrification captures not only class shift but also class inequalities and injustices created by capitalist urban residential markets and public housing policies. The rising housing expense burden for low-income households is the direct outcome of the gentrification process, and it has caused social problems such as eviction and

homelessness. The displacement of lower income groups from gentrified areas is a highly debated problem. It is evident that households who have been displaced are mostly renters. Martin and Beck (2016) found a positive correlation between rising costs of property tax in gentrifying neighbourhoods and the increase in involuntary moves of renters, and the negative effects on renters are by far higher than on homeowners. Especially in the long run, the decisions to move of homeowners are virtually not affected by gentrification nor property taxes because their housing costs are locked in and they tend to be more financially stable (Florida, 2017). Accordingly, owners tend to be more attached to the neighbourhoods they live in and are not exposed to the threat of eviction unless they can no longer afford their mortgages.

Not only is gentrification limited to the form of working-class displacement, it affects residents of different races as well. As gentrifiers move into an area, some racial groups who have become minority begin to move out because either they can no longer afford to live or have lost the sense of belonging to the community. In a study of racial boundaries in the 100 largest US cities, Tannen (2016) found that old racial boundaries moved and spread outward as more suburban whites moved back to urban areas, but the neighbourhoods did not desegregate. Between 2000 and 2010 in Philadelphia, for example, overall there are increasing black residents, but pockets of white residents had emerged quickly. He finally came to a conclusion that 'gentrification has not been diffuse, but instead occurred on the specific blocks along the boundary' (Tannen, 2016, p. 28).

In contrary, Freeman (2009) claims that, in the US, racial diversity increased in his study area during the study period between 1970 and 2000, even though it was also evident that cities in general were becoming more diverse as well. He asserts that segregation by race is an indirect effect of gentrification. In this regard, education seems to play a key role in the determination of the way different racial groups are affected by gentrification. For instance, it is found that black professionals have successfully settled in New York's Harlem because they embody many of the value of 'middle-class America'—i.e. education, property ownership, work ethic and self-reliance (Taylor, 1992). Therefore, it seems to be class position and lifestyle rather than racial difference that set some minority groups apart. However, in a few situations, a spatial mismatch tends to also be contributed by residential segregation by race. When this happens, minorities are in disadvantageous position as employment

opportunities are spatially inaccessible to them (Holzer, 1991). Accordingly, while segregation by class is likely to make political boundaries to coincide with class specific enclave, it appears that segregation by race tends to redefine job opportunity boundaries.

Although gentrification has been driven by much larger forces—e.g. public/private investments, economic boom and globalisation—rather than mere individual desires, it tends to be limited in particular areas of cities, including economically successful or 'superstar' cities. In a study of New York city's fifty-five sub-boroughs, only 27 per cent of all sub-boroughs is identified as gentrifying neighbourhoods, while non-gentrifying neighbourhoods made up 13 per cent and the rest (60 per cent) is catagorised as higher-income areas (Austensen et al., 2016). Changes in household and urban spatial structures have interacted with the level of housing supply in certain areas. The end result is an uneven geographical development of gentrification effects that go beyond individuals' controls. This problem is unavoidable in the capitalist economy due to the working of market mechanism and the delay in urban policies' effects. In this regard, it is important that public fiscal instruments, such as property tax, are able to capture changes in prices/rents and help redistribute income and urban developments to other more deprived areas of cities.

2.7 Conclusion

This chapter has reviewed the literature on general concepts of taxation and urban geography/justice. It highlights the role of taxation within wider economic policy contexts, and to describe key concepts related to city economies. The primary focus has been placed on the difference between direct and indirect taxes and how they can be working together in the actual economic settings. While indirect taxes (such as consumption and sale taxes) are believed to have less impact on income inequality, the literature suggests that this believe may not hold. What is more important is the balance between the two types of taxes and how well they can perform.

Two criteria emerged in the evaluation of tax systems: equity and efficiency. Equity in taxation is based on the benefit principle and the ability to pay principle. While both principles should be used in the determination of the equity of a tax system, it appears that the ability to pay principle is more viable in practice. As we will see later in this thesis, property tax systems are evaluated in terms of horizontal and vertical equity, which are the two dimensions of the ability to pay principle. It is also important to consider negative impact of taxation, especially the deadweight loss. This can be caused by both the demand and supply sides, and by either individuals or firms. The degree to which deadweight loss arises depends on the elasticity of demand and supply of certain goods as well as tax rate. More elastic demand and supply for a good and higher tax rate normally lead to larger deadweight loss.

In section 2.3, I reviewed urban economic theories dating back to Ricardo's and von Thünen's agricultural land rent theories. Even though these theories are based on settings that may not be wholly consistent with the modern world, their implications for subsequent land use theories are very profound. We have seen that the Alonso-Muth-Mills theories are based on the fundamental concepts of Ricardo and von Thünen. Alonso constructed a self-consistent theory that shed light on housing, which was a much neglected area at the time. However, not many policy conclusions could be drawn from Alonso's model until further empirical testings were performed by Muth and Mills. Their extensive empirical research has generated significant developments on Alonso's theory. Their theories have succeeded in explaining the behaviour of households in urban space, and are particularly fruitful in the study of the housing market.

In the proceeding sections we have seen that both the type and level of urban forms are crucial in the analysis of city economies. Type of urban forms determines the locational settings of the CBD, urban transport system, and other important activities in the urban area. All of these factors have influenced property prices differently. The literature also suggests that urban form must be viewed from different levels as some variables only valid at certain levels. Urban structure is another important concept that tends to vary from country to country. The city is constituted of not only physical attributes but also the relations of consumption, production and reproduction. Key theories have emerged from two schools: Keynesian and Neoliberals. While Keynesian theorists favour top-down policy making at national scale, the Neoliberals support devolution and depoliticisation of local governments.

Central to the topic of spatial justice are the concepts of social process, social relations, consumption and production. Spatial injustice arises when there is an absence of organisations that can facilitate the uneven distribution of resources in the city system. Location matters as spatial boundaries can cause uneven development, as capital flow more freely across boundaries. Marxist theorists view city as a site of (re)production; therefore, within the capitalism system of private property, residents should be allowed to appropriate their own spaces. In this regard, based on urbanist ideologies, Castells argues that that collective consumption is a means for social reproduction. The city is the site of reproduction rather than the mode of production.

Furthermore, economic globalisation is a powerful force that has shaped not only urban structure but also social class composition within the city. As I have shown the case of the housing market that has been greatly affected by occupational polarisation, it has particularly raised the concern for the effectiveness of the fiscal instrument that can be used to tackle the problem. Property tax is regarded as the key fiscal instrument that has great potentials in improving social inequality and this will be discussed in detail in the following chapter.

Contemporary urban problems were presented to draw attention to urban inequalities, with particular reference to gentrification. The explanations for gentrification fall into two categories: economic and cultural (see Smith, 1979). The economic aspect of gentrification arises from higher commuting and housing costs of suburban living that triggered the rehabilitation of inner-city areas. During the back-to-the-city process, high income groups were better off as they had more opportunities to

choose where they lived and were unlikely to be displaced. Low income groups were more exposed to eviction risks and have less housing options. The cultural explanation for gentrification relates to changing lifestyle that was enough to decrease the desirability for suburban homes and increase the demand for inner-city properties. This led to an emphasis on the value of consumption as the underlying force behind central city land use decisions (Ley, 1978).

In the next chapter, I will narrow the analytical framework down to the topic of property taxation. All aspects of property taxation including base, rate and administration will be thoroughly discussed. A large part of the chapter will be devoted to the evaluation of property tax as well as property assessment systems. Finally, the chapter concludes with recommendations for property tax reform.

Chapter 3 Property Taxation

In the previous chapter we looked at the workings of tax systems through an economic lens. The topics that I have reviewed so far are a growing area of tax research. We have looked at fiscal and urban economics, including efficiency and equity aspects of taxation in relation to urban structure and spatial justice. This chapter narrows down the discussion to property taxation, an area which is closely related to the concepts of urban geography discussed in the previous chapter. The main aim of this chapter is to establish the link between property tax level and incidence with respect to the nature of the tax system.

Section 3.1 explains the distinct characteristics of property tax using the categorisation proposed by the International Monetary Fund (IMF) and the Organisation for Economic Co-operation and Development (OECD). Section 3.2 investigates the role of property tax as a local tax. The subsequent sections (3.3-3.5) consider the concepts of the tax base, tax rate and tax administration, which are the three pillars of most property tax systems. Section 3.6 brings the justification for property tax incidence into focus and discusses the determination of fairness in property tax systems. It also describes ad valorem tax theory and discusses criteria by which property tax can be evaluated. Section 3.7 describes key factors that play an important role in the housing market, and the final section (3.8) presents two case studies of property tax reform attempts and proposes some reform strategies for property tax.

Since there has been very little empirical research carried out on the reformed property tax system in Thailand, and no study of its property assessment performance, this chapter will review the systems in various countries, in order to identify potential solutions for property tax reform in Thailand. The residential property market is the focus of this thesis, but other property markets are also analysed to understand the rationale behind taxation of different property classes.

3.1 Property Tax Classification

In principle, property tax is often categorised as a wealth tax. In practice, however, the classification is quite obscure. Property tax is an income/investment taxes when collected from owners of rental housings (landlord/landlady), or a consumption tax when levied on the owner-occupied housings. Therefore, property tax can have a wide range of effects on the economy and on society, which is why we must consider both economic and social perspectives.

It is evident from the guidelines for tax classification made by the IMF and the OECD (Table 3.1 and Table 3.2 respectively) that taxes are classified mainly according to the bases on which they are levied. The only difference between the two classifications is that the IMF views social security contributions as another class of government revenue separate from taxes.

The main theme of this thesis concerns the IMF's class 1131 (or the OECD's class 4100), recurrent taxes on immovable property, which is defined by the IMF as:

> …Taxes levied regularly on the use or ownership of immovable property, which includes land, buildings, and other structures. The taxes can be levied on proprietors, tenants, or both. The amount of the taxes is usually a percentage of an assessed property value that is based on a notional rental income, sale price, capitalized yield, or other characteristics, such as size or location. Unlike recurrent taxes on net wealth (1132), liabilities incurred on the property are usually not taken into account in assessment of these taxes. (IMF, 2014, p. 93).

In this regard, property tax is considered a direct tax, which can be adjusted to the individual characteristics of the taxpayer (Atkinson, 1977). This is particularly the case with recurrent taxes on immovable property, in which either owners or occupiers of taxable properties are the final bearers of property tax burdens. Property taxes imposed on property transaction—e.g. SDLT in the UK and Real Estate Transfer Tax in Germany—are considered an indirect tax because the burden of payment can be shifted towards the final

bearers. This type of transactional property tax is, however, not the primary focus in this thesis.

Table 3.1 Extract of the IMF classification of taxes

Codes	Tax Types
11	Taxes
111	Taxes on income, profits and capital gains
112	Taxes on payroll and workforce
113	Taxes on property
1131	Recurrent taxes on immovable property
1132	Recurrent taxes on net wealth
1133	Estate, inheritance, and gift taxes
1135	Capital levies
1136	Other recurrent taxes on property
114	Taxes on goods and services
115	Taxes on international trade and transactions
116	Other taxes
12	Social contributions
121	Social security contributions
13	Grants
14	Other revenue

Source: IMF (2014)

Table 3.2 Extract from the OECD classification of taxes

Codes	Tax Types
1000	Taxes on income, profits and capital gains
2000	Social security contributions
3000	Taxes on payroll and workforce
4000	Taxes on property
4100	Recurrent taxes on immovable property
4110	Households
4120	Other
4200	Recurrent taxes on net wealth
4300	Estate, inheritance and gift taxes
4400	Taxes on financial and capital transactions
4500	Other non-recurrent taxes on property
5000	Taxes on goods and services
6000	Other taxes

Source: OECD (2016)

3.2 Property Tax as a Local Tax

Local governments in many countries have been pressured to increase their self-collected revenues, particularly from property taxes. Sandford (2000) points out that good local taxes should meet the following criteria: evenly distributed and localised tax base; low administration costs (economical to operate at a small scale); having the potential to create high and reliable yield; and having the ability to control local disparities of wealth and promote local accountability. It seems that property tax has the potential to meet all the above criteria as, in most cases, properties are a major source of personal wealth and their locations are fixed. Therefore, it is more justifiable for local governments to increase taxes on wealth compared to other taxable sources.

Moreover, property tax is generally considered by economists as a good tax in terms of difficulty of evasion and promotion of local autonomy, which as a result can promote accountability at local levels (Slack and Bird, 2014). The levying of taxes on immovable property makes it difficult to avoid and easy to administer due to explicit tax bases. However, the role of property tax as a source of national revenue is quite limited. Bird and Slack (2004a) found that property tax is at best a minor revenue source for national governments in most countries, albeit more important in developed countries (OECD countries) than in developing and transition countries. Conversely, property tax is a more important source of revenue for local governments in developing and transition countries than in developed countries. Their findings suggest that there is more room for property tax to improve in terms of revenue generation—if we believe that wealth is an appropriate taxable source in order to improve social inequality by increasing income distribution.

Because property combines a number of facets, each of which requires different tax treatments, the question of how to tax property is a complex one. A house, for example, sits on land, the value of which can generate economic rent that, on economic efficiency grounds, should be taxed. But the house can be treated as either a consumption or investment or both, each of which is normally taxed differently. Regarding the design of property tax, Mirrlees et al. (2011, p. 369) suggest that the following issues must be carefully considered.

- Land, whether used for business or residential property, can be taxed at an arbitrarily high rate on economic efficiency grounds.
- Business property is an input into the production process and, on efficiency grounds, should not be taxed.
- Owner-occupied housing combines the features of an investment and a consumption good, and we should consider its taxation from both these points of view.
- Rental housing is an investment good from the point of view of the owner and a consumption good from the view of the renter. Overall, there is a presumption in favour of taxing it at a similar level to owner-occupied housing.

Although property taxes in most countries are locally collected, the importance of property tax as a local financial source is limited due to legal restrictions. Property tax is often subject to national legislation, which cannot serve local financial needs. As shown in Table 3.3, most local governments have limited control over the determination of property tax rates. Even when they have full control over tax rates, the power to decide tax structure is typically exercised by central governments. It can be argued on equity grounds that all properties in a country, particularly of the same class, should be treated similarly. Therefore, in principle, it makes more sense to have property tax structure decided by central governments. In practice, however, each locality has different circumstances and financial needs, which is the reason why local governments should have more control over property tax rates and structures. More accountability for tax decisions is placed at the local level when tax rates are set locally, which is a preferable situation in democratic systems.

Table 3.3 Reliance on property taxes by local governments

Country	Type of property tax	Tax base	Basis of assessment	Local discretion over tax rates	Property tax as percentage of local revenues
OECD					
Australia	State land tax; municipal rates	Land or land and improvements	Market value; rental value; or combination	Yes, with limits on annual increase in revenues	37.7[1]
Canada	Property tax	Land and improvements (sometimes machinery included)	Market value	Yes, restrictions apply in some provinces	53.3
Germany	Land tax	Land and improvements; farm properties also include machinery and livestock	Market value (rental income/construction costs); area in former GDR	Central base rates; locally determined leverage factors	15.5
Japan	Fixed property tax	Land, houses, buildings, and tangible business assets	Market value	Nationally set standard and maximum rates	25.5
United Kingdom	Council tax (local tax on residential property); business rates (central tax on non-residential property)	Land and improvements; some plant and machinery	Market value for residential; rental value for non-residential	Residential tax only; tax ratios for bands set centrally	33.0[2]
Central and Eastern Europe					
Hungary	Building tax; plot tax; communal tax	Unimproved value (plot tax); buildings (building tax)	Area or adjusted market value	Yes, within legal limits	13.6[3]
Latvia	Real estate tax	Land and buildings	Market value	No, but local governments can grant relief	18.2[4]
Poland	Urban real estate tax; agricultural tax; forest tax	Land, buildings and structures	Area	Yes, subject to prescribed minimum and maximum rates	9.7
Russia	Land tax; individual property tax; enterprise assets tax	Land for land tax; structures for property tax; assets for enterprise property tax	Area; inventory value of structures; value of assets	Yes, within narrow range set by senior governments	7.0
Ukraine	Land payments and taxes	Land	Area	No	9.3
Latin America					
Argentina	Property tax	Land and buildings	Market value	Yes	35.0[5]
Chile	Property tax	Land and improvements	Area by location for land; construction value for buildings	No	35.1[6]
Columbia	Unified property tax	Land and buildings	Market value	Yes, subject to central government limits	35.0[7]
Mexico	Property tax	Land and buildings	Market value	Yes	58.7[8]

Nicaragua	Property tax	Land, buildings and permanent improvements	Cadastral value	No	6.4
Asia					
China	Urban and township land use tax; house property tax; urban real estate tax; farm land occupation tax	Occupied lands; land and improvements	Area; market value or rental value	No	4.9
India	Property tax	Land and improvements	Most annual rental value; limited use if area and market value	Yes, subject to state restrictions	7.0-41.0[9]
Indonesia	Land and building tax	Land and buildings	Market value	No, but can change assessment deduction	10.7
Philippines	Real property tax	Land, buildings, improvements and machinery	Market value	Yes, subject to minimum and maximum rates	13.4
Thailand	Land and building tax	Land and improvements	Market value for land; replacement cost for buildings	No	8.0[10]
Africa					
Guinea	Rental value tax on housing; local business taxes	Land and buildings	Rental value	No	32.0
Kenya	Property rates	Land/improvements	Area; market value; or combination	Yes	15.0
South Africa	Rates on property	Land/improvements	Market value	Yes	21.0
Tanzania	Local building tax; national land rents	Buildings, structures or limited development	Market value; or replacement cost (if market value not available)	Yes	4.0
Tunisia	Rental value tax on housing; tax on vacant land; local business tax	Land and improvements (rental housing tax); land (tax on vacant land)	Area; rental value	No	32.4

Source: Adapted from Bird and Slack (2004b)

Notes:

1 Includes only local taxation and not the state tax on land.

2 Includes the local council tax and the local share of national non-domestic rates.

3 Includes other local taxes such as a tourism tax.

4 Percentage of local taxes.

5 This refers only to the municipal tax. There is also a property tax at the provincial level.

6 The property tax is a national tax earmarked for local governments; 40 per cent of revenues remain with municipalities where property is located.

7 Property taxes as a percentage of total Columbian local taxes.

8 Percentage of municipal taxes.

9 The range depends on the state.

10 An estimate based on the data from Fiscal Policy Office (2017) and Matichon (2019)

The determination of tax rate is also subject to the extent to which local governments finance their services. There is a link between the benefits of the proposed public services and the costs of providing them. Local governments should have the authority to determine property tax rates if they finance these services themselves, as they have an accurate perception of the costs and can make informed decisions. Particularly where central government controls the tax base, it is important for local governments to be able to set tax rates. To avoid distortions, however, there should be limits on tax rates (Bird and Slack, 2004b). A minimum tax rate is needed to avoid tax competition among jurisdictions as wealthier local governments, as well as those with wider tax bases, may reduce rates to attract business. A maximum tax rate is needed to avoid distortions from tax-exporting, which occurs when tax burden is borne by unintended payers. For example, local governments may levy higher tax rates on businesses because they believe that the ultimate tax burden is borne by non-residents (Boadway and Kitchen, 1999).

Regarding tax base, both land and developments are taxed in most countries. An important question is, as it is efficient to tax only land at the highest level, why most countries still tax both land and improvements? This can be explained by the difficulties that arise when trying to tax only land value. Especially in urban areas where the majority of land has been developed, it is impossible to extract the value of specific improvements from the overall property value. At best, one solution is to estimate replacement building costs and subtract them from the overall property values, which yields estimated land value. The missing components from the equation are the locational values that attach to both land and improvements. Even when precise costs for every detail of a property—e.g. floor tiles, granite kitchen tops, attic insulation—can be determined, it is still impossible to define ‘market value’ of land as separate from improvements because properties are always sold as a whole. Therefore, taxing both land and improvements seems to be a more convenient, and less time consuming, option for local governments.

Furthermore, it is found that, in most countries, property classes are treated differently. Single-family residential owner-occupied and agricultural properties are favoured, and are subject to tax reductions/exemptions or low rates, while non-residential properties are taxed at higher rates (Bird and Slack, 2004b; Gibb and Christie, 2015; McCluskey et al., 2007). In the case of residential properties, low-

valued houses are often exempted, and sometimes household circumstances are used as criteria for tax concessions/reductions. Agricultural land is normally treated on favourable terms, and is sometimes taxed at lower rates than residential properties or even exempted from tax, as in some African countries. Favourable treatment of agricultural land is due to social and political considerations, and with a view to preserving it from conversion to urban use. However, Maurer and Paugam (2000) argue that the tax differential is often not large enough to compensate for the much higher prices that would be paid for the conversion to urban use. Non-residential properties largely include commercial and industrial properties, which are often taxed at higher rates. In fact, there is little economic rationale to tax non-residential properties higher as it distorts land use decisions, especially on new developments. Ideally, similar rates on all types of properties would ensure that land development choice is based on the highest and best use.

3.3 Property Tax Base

Property tax bases are typically estimated from either land value, market (capital) value, rental value or by area-based measures (Gibb and Christie, 2015). Market and rental values are the predominant methods used across most Latin American, Asian and OECD countries. The market assessment method generally involves comparison of direct sales, in which the values of subject properties are derived from the market values of similar properties known as comparables. In general term, market value is the exchange price of a property if it is to be sold in an arm's length transaction and in the open market. Apart from the above qualities, comparables must be comprehensive (including a number of comparables rather than a single transaction), recent, verifiable and consistent with local market practice (RICS, 2012). Comparables are selected and adjusted for certain property characteristics—as there is no property that is exactly identical to another. The primary criticism of this sales comparison method is that it is subjective in terms of comparable sales selection and adjustment types.

Cost and income approaches are alternative common methods for estimating market value. Cost approach comprises two main components: estimations of land value (from vacant land sales) and building value (from construction costs). The approach is suitable for newly built or special use properties, for which comparable evidence is difficult to find. The income approach is normally preferable when subject properties are commercial. In applying the income approach, the appraiser calculates the net income (total income less expenses) and divides it by the yield rate (annual rental income divided by acquisition cost of the property). This method is particularly applicable to investment rental properties and the assessment result is more accurate when the subject property is occupied to full capacity (Wyatt, 2013).

In area-based measures, taxes are levied per areal unit of building or usable space (or both) according to assessment rate and size of the property. The assessment base of this measure is indirectly influenced by market values through the application of adjustment factors, which normally derived from outdated sales. The measure is still used in some less developed countries in Central and Eastern Europe and Africa (e.g. Ukraine, Tunisia and Kenya), where available property transaction data is less accurate due to the absence of well-developed property markets (Bird and Slack, 2004a).

For residential properties, there are several alternative assessment methods such as hedonic and repeat-sales. The hedonic method defines value as a mathematical function of housing characteristics by employing multiple regression technique to estimate the contribution of each characteristic to the total property value. This method requires detailed information on property characteristics, which are diverse from property to property and subject to constant changes. Even when data on property characteristics are sufficiently available, it is difficult for the hedonic model to capture some factors affecting housing price such as distinct neighbourhood characteristics or certain environmental factors (Calhoun, 2001). Since many of these factors are difficult to quantify, manipulation by a human assessor is often necessary, rendering hedonic models subjective.

The repeat-sales method also employs multiple regression technique to estimate repeat-sales indices. The method was first proposed by Bailey et al. (1963), who used data from the amount of tax stamps (and adjusted on the basis of information contained in the warranty deed) to construct the price index. The method was extended by Case and Shiller (1989) to account for differences in the sampling distributions of price changes over time between repeated transactions. Their weighted repeat sales (WRS) model uses generalised least squares regression to account for heteroscedasticity. Case-Shiller home price indices have been computed for 20 cities in the US and used by Standard and Poor's (Standard and Poor's, 2009).

An advantage of the repeat-sales method is that it is less data intensive than the hedonic method: it only needs price, sale date and property address to perform regression. However, the problems with the standard repeat-sales model are that the number of resale units is sometimes low and there are difficulties in determining net depreciation—despite the method proposed by Shimizu et al., 2010). To remedy this, a stochastic model may be used to help explain price changes of housings that have been sold repeatedly—using the estimation based on pooled data across the same period of study (OECD, 2013).

Land versus land and improvements

LVT is a classic concept in the history of taxation. Its long pedigree dates back to 1809 when David Ricardo proposed 'the law of rent', in which he argued that:

> A Land-Tax, levied in proportion to the rent of land, and varying with every variation of rent, is in effect a tax on rent; and as such as tax will not apply to that land which yields no rent, nor to the produce of that capital which is employed on the land with a view to profit merely, and which never pays rent; it will not in any way affect the price of raw produce, but will fall wholly on the landlords. In no respect would such a tax differ from a tax on rent. But if a land tax be imposed on all cultivated land, however moderate that tax may be, it will be a tax on produce, and will therefore raise the price of produce (Ricardo, 1911, p. 96).

As land is in fixed supply, especially under certain planning restrictions, it is not responsive to price change. Only landowners are liable to a tax on land value, of which the burden cannot be shifted to others. In this regard, two types of LVT should be clearly defined. First, vacant land should be taxed to encourage developments of highest and best use. It can be assessed by market comparison method if there are sufficient number of sales available. The assessment is straightforward as there are no building costs involved in the process. Second is the tax imposed on site value of developed land, which presents a challenge for assessment because urban property sales combine both values of site and improvements. An estimate of site value is usually made by employing market and cost approaches. Increases in site value tax are capitalised into lower property value; therefore, landowners are liable to higher tax than is the case with a tax on both land and improvements (Bird and Slack, 2004b).

However, apart from assessment difficulties, narrower tax base is another issue related to LVT. Assuming fixed and similar tax rates, a tax on site value tends to generate lower revenues compared to a tax imposed on the whole property. To compensate for a smaller tax base, tax rates need to be increased in order to produce comparable revenues for LVT. Higher rates create greater distortions and are politically unpopular. For this reason, it is easier to impose lower tax rates on both land and improvements (Bahl, 1998).

3.4 Property Tax Rate

Other than tax base, tax rate is another important determinant of tax burden. Even when assessment systems can produce accurate tax bases, the amount of tax liability depends largely on the tax rate indicated for each property. Property tax rates are usually determined by central governments but, in some cases, they may be set locally. In countries like Hungary and Columbia, local governments are granted discretionary powers over tax rates within certain limits determined by central governments; while in Argentina and Kenya, local governments are granted absolute discretionary powers (Bird and Slack, 2004a).

When property tax rates are determined locally, local governments can estimate their expenditure requirements and set tax rates accordingly after subtracting non-property tax revenues available. In England, for example, where all domestic properties are placed in within Bands A-H according to their national assessed values as of 1991, local authorities estimate revenue requirements from the council tax by subtracting any subsidies and revenues available from the central government and other sources. The amount of the council tax requirement is then set for Band D (middle range) so that the revenues raised from all properties across all bands add up to the level of the revenues required. Therefore, the percentage of the council tax across all bands are proportionately the same each year but the amounts of tax paid may be different.

Different rates may be imposed for different types of property—i.e. residential, commercial, industrial, agricultural and vacant land. Alternatively, the differentiation of property tax among different types of property may be done through the assignment of different assessment levels (as ratios of assessments), as in the Philippines. In such a system, a uniform tax rate can be applied but properties are assessed at different ratios, e.g. residential property is taxed at 20 per cent of market value while commercial property is taxed at 50 per cent of market value (Guevara, 2004). On benefit grounds, it can be argued that different classes of property benefit from local public services differently. Non-residential properties should be taxed at a lower rate than residential properties because owners of the former often provide more of their own services—e.g. security and garbage collection—than the latter (Slack, 2011).

On efficiency grounds, however, it can be argued that property tax should be heavier on the least elastic components of tax base—i.e. those components that are not

very responsive to a tax increase. Therefore, residential properties should be taxed at higher rates as business capital tends to be more mobile than residential capital. However, in practice, differential tax rates do not necessarily reflect either benefits received or supply elasticity of property owners/users as, in many countries, business-related share of government spending is less than business-related share of tax revenue, and residential properties are often taxed at lower rates (Kitchen and Slack, 1993; Oakland and Testa, 1995).

Another important question is whether property tax should be levied at flat or graduated rates. On equity grounds, it is reasonable to have progressive tax rates in order to achieve the income distribution objective. In some tax systems, progressive tax rates have emerged in the form of tax exemptions or reliefs for low-value properties. In other instances, tax rates increase with property values. Peculiar cases, such as the previous Thai system, involve the application of progressive, flat and regressive rates to council tax (see Section 4.4.1.2). However, it is surprising that progressive rates are applied to low-value properties while regressive rates are applied to high-value properties.

Differentiated tax rates are normally imposed according to property classes, but, in some cases, they are imposed on land as separate from improvements. In Taiwan, for example, a split-rate property tax treats land more favourably than improvements (Lin, 2010). Economic arguments for such a system are a reduction of the deadweight loss and more intensive use of capital and labour, as they are substituted for land when the tax is introduced (Cohen and Coughlin, 2005). This results in more productive use of land parcels and an increase in output in the metropolitan area. It is also found that a switch to LVT leads to denser patterns of land development and a reduction in urban sprawl (Brueckner, 2001; Brueckner and Kim, 2003).

3.5 Property Tax Administration

Tax administration refers to tax policy and the process by which it is administered. How well property tax is administered not only affects revenue but also determines its equity and efficiency (Bird and Slack, 2004b). There are three key steps in the process of property taxation (Ibid., p. 41):

(1) Property identification

(2) Preparation of tax roll

(3) Tax bills issuance, tax collection, and arrears management

In the first step, subject properties and their owners must be identified. This step involves the preparation of fiscal cadastral maps, which give information about property description, boundaries, past market and assessed values, etc. The second step involves the preparation of property assessments and appeals. This is when surveys usually take place to verify and update property data. In the final step that involves the issue of property tax notices/bills and collection, it is important to have well-established and functional enforcement and appeal systems to ensure maximum tax collections and to serve as error-correction mechanisms. All of these functions are normally performed by central/local government agencies. Although some functions may be outsourced to private contractors, Strauss and Sullivan (1998) found that the use of county rather than private assessors resulted in more uniform residential assessments.

Although, in principle, good administration can improve the efficiency and equity of a tax system, it is usually absent in practice. As pointed out by Bahl and Martinez-Vazquez (2008, p. 42), ‘the major problem with property tax is that it is difficult to administer and costly if administered well’. Given the long and detailed process of property tax administration, property tax tends to have high administrative costs compared to revenue yielded, especially if not managed properly. Poor tax administration would normally result in non-uniform assessment ratio and low collection rate. It may also lead to property tax inequity particularly when the same classes of property are treated differently. More importantly, when public confidence in the tax system cannot be maintained, demand for property tax reform increases.

3.6 Principles of Taxation Revisited

When measured against tax principles proposed by Smith (1776) property tax can easily comply with the requirement for certainty because of its immoveable tax base (see Section 2.2). Property tax can generate predictable revenue because it is usually levied on assessed value, which tends to be more stable than market value. Even though in theory assessed value should closely match market value, property tax reassessments usually take time, and are politically unpopular (Policy Exchange, 2013). In England and Thailand, for example, council tax is still based on the 1991 and 1978 market values respectively (Council Tax Act, 1965; VOA, 2016). Therefore, revenues from property tax do not normally fluctuate with cyclical swings in economic activities including real estate markets.

Furthermore, property tax meets the requirement for convenience in two distinct ways. First, there are many methods by which property tax can be paid, such as via the internet, telephone, standing order, etc. Second, the timing of property tax payments is convenient for taxpayers as, in many systems, the total sum of taxes on occupancy is payable in monthly installments to help spread the costs. Also, taxes on transfer such as SDLT and Inheritance Tax (IHT) are normally collected at the time of transfer, making tax payments very simple.

Nonetheless, difficulties arise when we consider equity and efficiency in property taxation. To comply with the equity principle, property assessments must be accurate. Accuracy of assessments is typically measured by how close they are to market prices. In theory, if assessed values perfectly reflect fluctuating market prices, equity and certainty principles seem contradictory as it is unlikely that revenue from property tax is stable. In practice, this situation can hardly happen because property tax is based on estimation and any change is largely dependent on the frequency of reassessment. Bird and Slack (2004b) found that, in 25 case study countries, reassessments mostly take place every one to ten years, but in a minority of countries, there is no predefined assessment cycle. The frequency of reassessment does not only depend on the level of economic development or the size of countries, it also depends on national and local politics.

In order to keep assessments up to date, expertise of assessors and sufficient financial resources are indispensable. In the Philippines and Hungary, for example,

infrequent assessments are caused by a lack of knowledgeable staff and assessment tools (Guevara, 2004; Tassonyi, 2004). A lack of qualified assessors is in part caused by an absence of coherent assessment systems. Ideally, there should be local government assessing agencies located in every province or taxing jurisdiction, but this requires a considerable amount of public finance, which may not be worth the collectable tax amount. Comprehensive and detailed property assessments normally require a lot of manpower and training, especially in surveying. Computer-assisted assessment systems can help reduce assessment time, but without accurate and up-to-date information they cannot give reliable results.

Accordingly, assessment systems can be improved based on the three following observations. First, a strict legal system is essential for achieving accurate reporting of sale prices. The involvement of solicitors in facilitating property transactions results in reliable sale prices, which seems to be missing in many developing countries including Thailand. Second, there must be a good record keeping system for property transactions so that sale data are properly archived for future tax assessment purposes. Third, integration of different government agencies is the key to keeping assessments up-to-date (Bird and Slack, 2004b). For example, when a property is sold and the information is recorded in the land registry, notification should be sent to property valuation agencies and local governments; or, when a building permit is granted, local governments should notify other government agencies responsible for maintaining the property tax roll. These government agencies should share the same property data base.

While most of these solutions are difficult to achieve in practice, many countries have adopted banding assessment systems as an alternative to discrete value assessment on each property. The banded approach has been used to ameliorate the unpopularity of property taxes by grouping assessed values into a few ranges. This results in quicker and cheaper assessment processes, which make the assessors' task easier. The approach can also reduce the volume of appeal challenges because banding generates much less precise assessments (McCluskey et al., 2002). Compared with discrete value assessment, it could be said that the banded approach requires less property information and training for assessors. However, there are drawbacks to the banded structure. A dilemma of banding determination is that it tends to cause property tax inequity if the value range is too wide, or to cause more appeal challenges if the value rage is too narrow—as it becomes more similar to discrete value assessment. Without frequent

reassessment, the banding becomes tainted with inaccuracy because certain types of residential properties increase—or decrease—in value when compared with others in the same geographical locus (RICS, 1998). Therefore, frequent assessment updates are mandatory regardless of banding characteristics.

3.6.1 Concepts of Fairness and Equity in Property Taxation

Fairness in taxation is a controversial issue that directly relates to the historical, cultural and social background of the taxpayer (Vlassenko, 2001). Traditionally, the terms "fairness" and "equity" are often used synonymously. In property taxation, however, the distinction between these two terms should be made clearly. Woolery (1989) suggests that 'fairness' pertains to the legislation upon which the tax is promulgated, whereas 'equity' refers to the administration of the property tax system. In other words, equity, or more specifically, assessment equity, is a measure of how well property tax is administered in terms of assessment and appeal processes, where fairness is measured by how well property tax is structured in the legislation. The IAAO (2010) claims that property tax equity can be achieved through the enforcement of assessment standards.

From vertical equity perspective, it is crucial to have progressively distributed tax burdens. In property tax, progressivity is largely determined by tax rate. Under a strict economic definition, Mirrlees et al. (2011, p. 24) assert that a tax is said to be progressive when average tax rate rises as tax base rises. This means property tax is progressive when average rate rises as property value rises. However, a property tax system can hardly be deemed equitable if tax rates increase based on inaccurate property assessed prices—i.e. obsolete or wrongly assessed tax bases. Therefore, in order to prove progressivity in a property tax system, it is essential that we verify that assessed prices are accurate and able to reflect market values. If assessed prices are accurate then we can assume that progressive tax rates would yield vertically equitable outcomes, and the same concept can be applied to horizontal equity perspective as well.

Assessment level is a key concept in the literature on property tax studies. It refers to 'the common or overall ratio of assessed values to market values' (IAAO, 2013a). The meaning of the term 'overall ratio' itself is vague, especially when the context under discussion is not clear. In property taxation, overall ratio normally refers to the common (or average) level of assessments in the entire taxing district (Cheng, 1970). It is used as a benchmark to determine whether the level of assessment of the subject

property is appropriate or not. There are two instances where assessment level is particularly relevant. First is the evaluation of assessment quality and equity, often done by comparing assessment levels between taxing jurisdictions (*inter alia*, Beal et al., 2017; Krupa, 2014; Lin, 2010; Payton, 2012). Second is the use of assessment level in property tax abatement cases to determine the appropriate level of tax reductions/exemptions (see Cheng, 1970, p. 51).

There are three concepts concerning the quality of property tax systems that should first be clearly defined: assessment equity, assessment uniformity and assessment bias. Assessment equity is the degree to which assessment to sales ratios—A/S Ratios for short—of all properties are constant on the day of assessment. There is perfect assessment equity when the A/S ratios of all properties are equal, regardless of the value of the ratio (Paglin and Fogarty, 1972). Assessment uniformity and assessment bias are interrelated concepts. Assessment uniformity means each property has to be treated equally—i.e. to be assessed by the same standard and having the same assessment ratio (IAAO, 1990). Assessment bias refers to circumstances when different classes of property have different A/S ratios (IAAO, 1990, 2013b).

Vertical and horizontal inequities are two components of assessment inequities that have emerged in the literature. Vertical (assessment) inequity arises when assessment levels of higher-value properties are different from those of lower-value properties (IAAO, 2013a). Vertical inequity can be either regressive or progressive. Regressive vertical inequity occurs when higher-value properties are underassessed relative to lower-value properties, and vice versa for progressive vertical inequity. Horizontal inequity arises when owners of properties with similar values pay different taxes (De Cesare and Ruddock, 1998). In property taxation, the measurement of horizontal inequity does not take into account the income of property owners. Only market value, and sometimes property type, are used as criteria to compare tax liability. Therefore, from both perspectives of inequity, people with low active income who own high-value properties (asset rich, cash poor) are deemed to have high ability to pay within this analytical framework.

Depending on the tax system, it may be more appropriate to take into account tax exemptions in the evaluation of property tax burden. Assessment level is certainly a good indicator of property tax liability, but it may not be completely accurate. Some owners/occupiers are eligible for extensive property tax exemptions due to their

personal status—e.g. number of children, occupations, and number of occupiers. Property tax exemptions can cause a marked difference in tax liability for people who own properties of similar values. Tax exemptions may be in the form of reduced tax rate or as a percentage of the reduction from total tax liability. Tax exemptions can be calculated in comparison with the assessment level. A lower assessment level (below one) would indicate an inclination towards lower tax liability as well as properties with extensive exemptions. However, the analysis of tax exemptions should be carried out when there is detailed data on personal circumstances. This will help justify the different levels of tax burden that fall on different groups of taxpayers.

In the following section we dig deeper into the topic of property tax (in)equity and the criteria by which property tax systems can be evaluated. Property tax incidence is a concept that relates to the benefit and ability to pay principles. In this regard, property assessment remains the focal point of discussion.

3.6.2 Debates on tax incidence

The collection of recurrent taxes on property is often justified by the fact that local governments supply goods and services, ranging from those that are often regarded as public goods such as electricity and water, to those that are pure public goods by nature such as roads, police and libraries. In other words, property tax may be considered a quasi-charge for public services provided by local governments, which is reflected in the value of property. Local taxpayers are inevitably tied to the use of local services. The connection between types of services provided by local governments and the benefits to residents and property values justify the collection of the property tax (Fischel, 2001).

Three strands of thought regarding property tax incidence have appeared in the literature: the traditional view, which asserts that property tax burdens borne by consumers fully translate to higher house prices; the benefit view, which argues that property tax is literally a user fees or payments for local public goods and services; and the capital view, which claims that the distortionary effects of property tax cause inefficient allocation of capital.

The traditional view was first articulated by Simon (1943), and expanded upon by Netzer (1966). Using the partial equilibrium approach to analyse the housing market, they argue that the entire property tax burden is borne by local consumers in the form

of higher house prices. Assuming that the national return to capital is fixed, local capital in the long run can freely move between jurisdictions until after-tax return to capital equates to its national counterpart. This conclusion is opposed to the theory posited by Seligman (1910) that tax on value is separable into landowner's and renter's/occupier's components while tax on gross rental is not. This, however, depends on the elasticity of demand for housing. If the demand for housing is inelastic then property tax burden is divided between landowner and occupier/renter in the ratio of the site value to improvement value (Pierson, 1912).

More recently, debates have moved away from pure economic principles and towards practical aspects of property tax. Scholars who take the benefit view follow the renowned local government model of Tiebout (1956). He proposes that public service expenditures equate to the property tax paid by residents. Efficiency of local public services provision can be achieved if consumer-voters are fully mobile (voting 'with their feet' for alternative combinations of public services and tax levels) and there is competition between local governments. Under such assumptions, taxpayers tend to favour property taxes to other taxes because they can see explicitly how the property tax translates to the benefits received in return.

Tiebout's model was later extended by Hamilton (1975), who applied further restrictions in terms of zoning (land use restrictions). The model sorts individuals into local jurisdictions which are homogenous with respect to house values. Given definite housing and public service requirements, individuals usually match their demands by purchasing homes at the minimum value established by zoning constrains. The key assumption is that there is no subsidisation of public services to neighbour communities (by allowing people to pay more than minimum house value). This being the case, the model implies, people will move to the community that perfectly matches their demands for housing and public services, assuming absolute mobility of residents.

Subsequently, Hamilton (1976) improved his model to better fit real life scenarios where house values in communities are heterogeneous regarding housing consumption. However, he assumes that homogenous communities still existed, which implies that it is unlikely for individuals to receive lower benefits than any property taxes paid. Hamilton asserts that, in long run equilibrium, property taxes would be perfectly capitalised into property values. This is the case where a relatively expensive home sells at a discount and a relatively inexpensive home sells at a premium, reflecting the

difference between property tax and benefits received.

In their studies of the commercial and industrial property markets, Fischel (1975) and White (1975) confirm the existence of zoning and fiscal capitalisation posited by Hamilton (1975), and comprehensively includes land use regulations in their analyses. They argue that, in the long run, firms are mobile and will move until the marginal value of public services is equal to their tax payments in a jurisdiction. Fischel (1985) also points out that nearly every American municipality of any size has been clearly divided into zones, in which certain activities are allowed and some are prohibited. Although zoning laws cannot legally specify minimum values of new housing developments (in order to prevent adverse fiscal impact on existing residents), the matrix of lot-size, quantity and quality standards could indirectly determine the minimum value.

On the contrary, the competing capital view—or the 'new view'—considers property tax a distortionary tax that discourages improvements and causes underutilisation of land. As argued by Mieszkowski (1972), and subsequently confirmed by Zodrow (2001), assuming fixed capital stocks, capitals tend to be driven out from high-tax jurisdictions to low-tax jurisdictions as a result of property tax differentials. In contrast to the benefits view, tax incidence in the capital tax view is relatively progressive because of the profit tax effect borne by local residents. The imposition of the property tax causes the outflow of capital, which leads to the rise of tax burden on local factor owners and local consumers. This implies that local residents tend to bear the full tax burden, which makes property tax progressive and redistributive.

Mieszkowski and Zodrow (1989) criticise the model developed by Hamilton (1975), which was later extended by White (1975) and Fischel (1985), that zoning is too crude, either to limit the type of firms or residents that can enter each jurisdiction, or to impose minimum property requirement. Fischel (2001) argues that the critics underestimate the ability of local governments and communities to solve the free rider problem through exaction processes (see also Altshuler et al., 1993; Been, 1991). If zoning worked perfectly it would indeed be able to specify the taxable property for each new development, and, each new construction would 'pay its own way in municipal costs' (Fischel, 2001, p. 159). Exactions are usually in the form of side payments collected from developers, which are intended to compensate for fiscal

deficits resulting from new developments that fail to meet minimum tax base. In order to achieve this, however, local governments must have very precise tax data base and are able to accurately estimate future expenses.

3.6.3 Evaluating the Property Tax System

Tax systems can be evaluated based on a number of criteria depending on the objective of the tax. The types and designs of a tax affects the economy, markets and people's behaviour in many ways. It is important to look at the actual purposes of a particular tax when assessing it. As a fiscal instrument, taxation can serve several policy objectives, which include allocation function, distribution function and stabilisation function (Musgrave and Musgrave, 1989). All three functions should be analysed in order to estimate how well a property tax system works. However, if we are only interested in particular functions of the tax, it is also possible to analyse these functions separately. This largely depends on the availability of data and the time horizon.

Each of the property tax functions are different in nature and require different evaluation approaches. In evaluating the allocative effect of property tax, there are two important questions that we must consider. First, how much the effective supply of property (including land) increases as a result of property tax? This concerns the levy of property tax on certain types of properties such as vacant and under-occupied properties, which should be taxed at a higher rate in order to eradicate excessive wealth accumulation, price volatility and economic rent. The second question is how much property tax is capitalised into property price? In this case, the property price mechanism operates under the assumption that the supply of property is inelastic, which means that an increase in property tax will decrease demand and lower prices, and vice versa (Sirmans et al., 2008). Therefore, we will consider property tax as a fiscal instrument that aims to regulate prices of certain properties in the market such as under-occupied properties and housing for people on low incomes.

The distributive effect of property tax can be measured by how much income and wealth are transferred between different income or social groups. While it is quite difficult to track income and wealth transfer at a macro level, we can assume that local governments are capable at performing their jobs—by translating tax revenue to required local services—and instead estimate the level of actual revenue collected in relation to potential revenue calculated from the market value of all taxable properties.

Linn (1980) proposes a pioneering method of determining the level and growth of property tax revenues. In his model, the factors contributing to revenue performance are collection effect (as represented by collection ratio), statutory tax rate, tax exemptions and assessment practice (as represented by assessment ratio).

Lastly, taxes on property stabilise the property market through their effects on price. Property tax performs as a user cost (or cost of ownership), which, if levied at progressive rates and appropriate level, can reduce price volatility in the property market in the long run. If the user cost is high enough, it will regulate the rate of return from property and thus keep growth in property price at a normal level. By comparing the UK with Denmark during the post-1996 period, Muellbauer (2005) claims that what helped Denmark avoid macroeconomic imbalances—excess house price and consumption growth, overvalued exchange rate, etc.—was its progressive property tax with market-related assessments, which was missing in the UK at the time. What causes imbalances in the economy as well as price volatility in the property market is the lack of a property tax that can maintain the user cost at a positive level over a long period. Econometric models that differentiate fundamental- from bubble-driven property price changes can be used to estimate the stabilisation performance of property tax (*inter alia,* Abraham and Hendershott, 1996; Muellbauer and Murphy, 1997). Fundamental-driven changes can be estimated from factors such as earned income, interest rates and housing stock relative to population number (Muellbauer and Murphy, 1997).

Even though the allocation and stabilisation functions directly concern the fairness of property tax, it is not possible to evaluate their effects in the short run, particularly at the early stage of a new tax implementation as is the case with Thailand. Therefore, this thesis focuses on the distribution function of property tax, which can be evaluated from the ability of the tax to finance local governments. As mentioned earlier, this can be done by analysing the capability of local governments to collect property tax, which includes these factors: tax receipts, tax liability, assessed values of taxed properties, and assessed and market values of taxable properties. But before we look any deeper into this, we should first consider ad valorem tax theories to understand the logic of how property tax is derived.

As pointed out by Moore (2008), two strands of ad valorem tax theory arise from the literature: normative and descriptive. Both theories are in fact based on the benefit

tax view, which considers property tax as an allocation mechanism for the costs of local services. Each property in a taxing jurisdiction should share in the costs proportionate to its value. In the normative theory, tax rate is defined as (Fischel, 2001; Merriman, 1987; Moore, 2006; Netzer, 1966; Oldman and Aaron, 1965):

$$R_{TFq} = L_F / A_q \tag{3.1}$$

where R_{TFq} is the required tax rate; L_F is the aggregate levy for fund needed (F); and A_q is the aggregate assessed value for taxing unit q.

Equation 3.1 is a simplified version of tax rate setting, which neglects certain rules and regulations as required by property tax legislation. Property tax for an individual property can be expressed as:

$$T_i = \sum_{F=1,h} R_{TF} \times A_i \tag{3.2}$$

where T_i is the amount of property tax of the i^{th} property; R_{TF} is tax rate; and A_i is assessed value (sometimes called assessed market value estimate) of the i^{th} property.

The descriptive theory of real property taxation adds more complexity to the normative theory to better reflect how property tax actually operates. The model for the theory can be expressed as (Bartle and Krane, 2004; Moore, 2008; Oates, 1999; Rosen, 1992; Zodrow, 2001):

$$A_n = \sum_{i=1,n} NAV_i \tag{3.3}$$

where A_n is aggregate net assessed value for all n properties in the jurisdiction; and NAV_i is net assessed value of property i, which can be expressed as:

$$NAV_i = [M_i + e_i] + \sum_{i,j=1,m} (E_i + I_E) \tag{3.4}$$

where M_i is the actual market value of the i^{th} property; e_i is the error term that accounts for errors from random factors, incorrect property descriptive data and assessment models; E_i is the property tax exemption for the i^{th} property; and I_E is the error in applying E (adjustment for the exemption).

3.6.3.1 Evaluating distribution performance of property tax

Property tax performance can be empirically measured against a set of legal and administrative factors—i.e. tax rate, tax base (valuation), collection capacity and assessment coverage. A simple ratio model (Bahl and Linn, 1992; Linn, 1980) is as follows:

$$\frac{TC}{MV} = \left(\frac{TC}{TL}\right)\left(\frac{TL}{AV_T}\right)\left(\frac{AV_T}{AV_A}\right)\left(\frac{AV_A}{MV}\right) \tag{3.5}$$

where TC is the tax revenue collected; MV is the market value of all taxable properties (tax base); TL is the statutory tax liability; AV_T is the assessed values of taxed properties; and AV_A is the assessed values of all properties.

From Equation 3.5, the formula of the total tax revenue collected (actual tax receipts) can be expressed as:

$$TC = \left(\frac{TC}{TL}\right)\left(\frac{TL}{AV_T}\right)\left(\frac{AV_T}{AV_A}\right)\left(\frac{AV_A}{MV}\right)MV \tag{3.6}$$

In words, Equation 3.6 translates into:

Actual tax receipts = Collection ratio × Statutory tax rate × Coverage ratio × Assessment ratio × Tax base at market value

Therefore, by dividing both sides of Equation 3.6 by the statutory tax base and tax base at market value, we will get the ratio of actual to potential tax receipts (Lewis, 2003). That is:

$$\frac{TC}{\left(\frac{TL}{AV_T}\right)MV} = \left(\frac{TC}{TL}\right)\left(\frac{AV_T}{AV_A}\right)\left(\frac{AV_A}{MV}\right) \tag{3.7}$$

Equation 3.7 shows the formulation of the ratio of actual to potential tax receipts, which is used by Lewis (2003) as a measure of administrative performance of property tax. In words, the equation translates into:

Ratio of actual to potential tax receipts = Collection ratio × Coverage ratio ×Assessment ratio

Lewis (2003) compares results from urban and rural areas in Indonesia to find the cause of the under-performing property tax system. He found that valuations are the weakest component of the property tax system, with the overall assessment ratio in

1997 of about 0.6. On average, the coverage and assessment ratios in the rural areas are lower than those in the urban areas, but the local governments in the rural areas could collect a higher proportion of tax receipts to total tax base.

In Equation 3.7, the collection ratio is calculated from the values of actual tax collected over the total assessed values of property tax rolls. The ratio represents how efficient local governments are in raising revenue from property tax, which largely depends on billings, payments and enforcement. The coverage ratio is calculated from the assessed values of taxed and untaxed properties. It represents how much actual property tax base (assessments) can cover potential tax base (market values of all taxable properties), which has a direct influence on the quality of property tax rolls. Higher ratios mean the tax base is larger and better utilised. Lastly, the assessment ratio reflects how accurate the assessed values are compared to the market values. More accurate assessments would result in a higher ratio, with a ratio of one indicating that assessed values perfectly represent market values. Any ratios over one reflect over-assessments and any ratios below one reflect under-assessments.

A common cause of outdated and inaccurate assessments is that they are based on stocks of estimated values rather than on market prices derived from a flow of actual property transactions. Consequently, there have been growing concerns over the fairness of property tax. A major contributor to the problem is infrequent formal assessment of real property. Property assessment by market comparison approach is widely used in many countries because it acknowledges changes in national/local economies and distribution of property-related wealth (IAAO, 2010). As previously mentioned, property reassessment is politically unpopular and can be as challenging as tax introduction itself. The following section reviews studies that evaluate market-based property tax systems in comparison with non-market ones.

3.6.4 Assessment Performance: Market v/s Non-market Assessments

An important distinction between the property tax and other taxes is the process by which tax base is determined. Property tax is largely based on assessed values. Two main assessment systems, market and non-market, have long been at the centre of the debates. Market value assessment estimates the market price that would be struck between a buyer and a seller under arm’s length negotiations. Assessed price can be obtained by a variety of approaches such as comparable sales, depreciated cost and

income that the subject property can generate. Nonmarket value assessment refers to methods based on factors other than actual transaction prices such as property sizes, ages and other qualitative attributes of the subject property.

Several studies have revealed that inequitable tax burdens are the result of deviations from full market value assessment approaches (Bowman and Butcher, 1986; Bowman and Mikesell, 1978; O'Sullivan et al., 1994; Sjoquist and Pandey, 2001). It has also been found that economic distortions within and among jurisdictions are the result of inequitable tax burdens caused by nonmarket assessment approaches such as the index-based approach, which is also widely used in property mortgage security valuations. This approach makes it possible for many countries to frequently update their property tax assessment database using multipliers calculated from a number of property sales. Properties are grouped into zones according to their location, types of use and other important characteristics. Each zone is then assigned with one multiplier, which determines how much assessed price can increase (or decrease).

Most inter-jurisdictional studies have attempted to reveal spatial distribution of property tax burdens. In Taipei, an evaluation of the split-rate property tax system—in which land is taxed at a higher rate than improvements—reveals that spatial inequity is caused by the failure to reflect certain location-associated price-determining factors in assessment rules (Lin, 2010). Valuation practices have a significant influence on tax burdens, and assessment errors tend to create a gap between market forces and existing property tax legislations.

Statistical analysis of the Israeli property tax system by Horne and Felsenstein (2010) suggests that the most important predictive variable of property tax is property sales value, followed by expenditure per capita. However, the weakest component of the assessment process is differential rates, which, it is claimed, are not diverse enough to reflect the immense range of property values. By expanding the differential rates within the same tax criteria, the relation between property value and expenditure has been improved.

Moreover, there are several studies of the English council tax that attempt to estimate the fairness of property tax by determining the relationship between household income levels and property values. Contrary to the arguments presented by Kenway and Palmer (1999) and Muellbauer and Cameron (2000), Davies et al. (2007) found that, in overall terms, there is a positive relationship between income and property

value, meaning that the Council Tax is vertically equitable and progressive, with the exception of higher tax burdens in the lower income group (£0-£100 to £200-£300 per week) and among couples and non-pensioners.

In his intra-jurisdictional study, Payton (2012) found that inequity caused by market value assessment standards was somewhat similar to that caused by nonmarket assessment systems. He bases his argument on unexplained assessment errors that are closely associated with poor performance by assessors. In a study of value-based assessment systems by Krupa (2014), it was found that both horizontal and vertical equity can be maintained under conditions in which the property market is stable and liquid enough, and assessors have adequate skills to precisely derive actual market values.

In addition, by comparing two cities, Shanghai and Chongqing, Bai et al. (2014) identify the opposite effects of property tax on housing prices. Their ordinary least squares (OLS) model puts more weight on the control cities than the treatment cities. The study shows that the property tax lowered home prices in Shanghai by 11 to 15 per cent, but spill-over effects from high-end to low-end property has caused property prices in Chongqing to increase by 10 to 12 per cent (Ibid.).

3.6.5 The challenges of property tax reassessment

While many methods for conceptualising property values exist, most countries do not frequently reassess property for taxation purposes. Property market value is the most appropriate basis for taxation but, as we have seen, spatial and qualitative criteria have taken its place. Accurate initial assessment (at the point of property tax introduction) alone is not enough to make property tax fair and efficient; periodic reassessments are essential as well.

Apart from being politically unpopular, there are several problems that hinder frequent property reassessments. In Hungary and the Philippines, for example, problems concerning reassessment stem from lack of knowledge, expertise and resources in making sales comparisons. Also, the lack of integration between government agencies, particularly in cadastral and registry systems, is the main cause of obsolete assessments in many countries (Bird and Slack, 2004a). Literature suggests that the time period between mass reassessments should be shortened, particularly

during housing (and perhaps economic) crises; and the interim adjustment by non-ad valorem approach ought to be abandoned in order to promote equity.

3.7 The Determinants of Housing Prices

Countless studies, especially hedonic ones, have attempted to determine the relationships between certain variables that have positive and negative impact on housing prices in urban areas. Prominent variables that have positive correlation with housing prices include urban rail transport (Bae et al., 2003; Jenks, 2003; Nelson, 1992; Richardson and Jensen, 2008; Vichiensan et al., 2011), open and green space (Bark et al., 2011; Cho et al., 2009; Conway et al., 2010; Zou, 2015), school performance and proximity to school (Davidoff and Leigh, 2008; Des Rosiers et al., 2001; Ferrari and Green, 2013; Zahirovic-Herbert and Turnbull, 2008) and proximity to CBD (Adair et al., 1996; Chen and Hao, 2008; Xiao et al., 2016; Zou, 2015). Variables that have negative correlation with housing prices include spatial fragmentation of land use activities (Kuethe, 2012), and proximity to environmentally intrusive factors such as airport, incineration plant, or cell phone base stations (Brandt and Maennig, 2012; Cohen and Coughlin, 2008; Zhao et al., 2016).

Housing value, like many other commodities, is determined by the value of its characteristics, which follows Lancaster's (1966) theory of consumer demand. Housing characteristics differ from those of other goods in that they are location specific. Their characteristics are shaped by the surrounding physical environment (Kuethe, 2012). This is probably why there has been a substantial body of research on the determination of the price impact of various land use activities on nearby properties. Munroe (2007) demonstrates that a variety of spatial factors that collectively influence property values are reflected in land markets. Therefore, it is more appropriate to assume that house price modelling should account for a large number of land use activities rather than just one or a few. In the remainder of this section, we will see that many of the variables cannot be conceived as having entirely positive or negative influence on housing prices. Other important considerations include various social, economic and geographical factors such as neighbourhood type and spatial dependence of random variables. Influence of these factors varies from city to city, and from country to country. A single variable may have different effects on different types of housing located in the same area.

The presence of an urban rail transit system improves accessibility to properties. Impact of rail transit systems on housing values have been measured by innumerable applications of the hedonic pricing model. Several studies confirm that urban rail transit

systems have a positive impact on house prices and that homeowners directly benefit from improvement in transportation in terms of the decrease in commuting time and costs (Bajic, 1983; Vichiensan *et al.*, 2011). However, the effects seem to vary in a number of ways. Focusing on neighbourhood level, Nelson (1992) found that elevated heavy-rail stations have a positive price impact on single-family homes in lower-income neighbourhoods, but have negative effects in higher-income residential zones.

The effects of an elevated rail service on housing price can be explained by a simple benefit-cost analysis, in which, for example, Nelson (1992) claims that noise, traffic, and other forms of nuisance associated with the elevated rail development offset the accessibility benefits in higher-income areas. In a study of Bangkok mobility systems, Richardson and Jensen (2008) argue that the BTS Sky Train is an iconic transit system that allows people to move seamlessly above the dangerous, polluted and congested city. This leads to an establishment of time value and a breakdown in the relationship between home and workplace (Richardson and Jensen, 2008). Empirical research shows that the Sky Train has a remarkably positive impact on residential property values but the price is less sensitive in high density business areas (Vichiensan and Miyamoto, 2010b; Wissink et al., 2005).

Gatzlaff and Smith (1993) and Forrest *et al.* (1996) similarly conclude that announcements of new urban rail systems and proximity to rail transit stations have a weak relationship with house price growth. House price patterns do not seem to change much before and after rail developments. In contrast, Bae *et al.* (2003) assert that the subway line 5 in Seoul had significant positive effects on house prices but only prior to the opening, which confirms the impact of price speculation in the housing market. It was the Korean government's policy of spreading public investments further from the CBD, aiming to expand benefits to the wider population, which has enhanced not only accessibility but has also increased employment and income distribution. A similar conclusion is drawn by So *et al.* (1997), whose study of Hong Kong housing markets reveals a strong positive relationship between house prices and service frequency of public transport, especially for middle income households. There are also a number of studies that attempt to quantify the effects of urban rail transport lines in terms of increased housing values and proximity to stations (Hess and Almeida, 2007; Malaitham et al., 2013; Wei et al., 2012). Most of these found varying impact of urban

rail transport lines, which largely depend on land use types and frequency of trains or other characteristics of the lines.

There is extensive literature that suggests that location and neighbourhood characteristics are significant determinants of house prices (*inter alia*, Cervero and Duncan, 2002; Diao and Ferreira, 2010; Vichiensan and Miyamoto, 2010a; Vichiensan et al., 2011). The direct definition of the term 'location' refers to the specific placement of a property. However, since a property's location is fixed, what actually defines location are elements of the surroundings such as transport facilities, recreational centres and schools. These elements can be considered as neighbourhood characteristics. The quality of a location may be represented by variables such as distance to transport infrastructure (McDonald and McMillen, 1990), distance to the CBD (Dowall, 1992; Forrest et al., 1996), distance to schools, parks or other green spaces, and land use zoning (Lin and Hwang, 2004). Some studies chose region-specific variables such as flooding (Aluko, 2011) or demographic attributes such as population density and median income (Brueckner and Kim, 2003; Malaitham et al., 2013) as representative attributes of locational effects on property values.

Open and green spaces have a significant positive impact on house prices in many ways, depending on the type and location of housing. It should first be clarified that the two terms should not be used interchangeably. Open space is 'any open piece of land that is undeveloped—has no buildings or other built structures—and is accessible to the public' (EPA, 2017). Examples of open space are green space, schoolyards, playgrounds, public seating areas, public plazas and vacant lots (Ibid.). Open spaces serve a wide range of needs, including recreation, aesthetics, wildlife habitat, and stormwater storage and filtration (Cho et al., 2009). By distinguishing between fixed (e.g. public parks and golf courses) and adjustable (e.g. agricultural land and vacant properties) land uses associated with open spaces, Smith et al., (2002) found that the adjustable type of open space tends to be more sensitive to market forces, and thus affected more by residential location choices. Most studies similarly concluded that homebuyers are willing to pay premiums for proximity to green space (Bark et al., 2011; Conway et al., 2010), and prices of smaller residential units or apartments are more sensitive to such proximity, particularly to large parks (Czembrowski and Kronenberg, 2016). In their spatial temporal study, Cho et al. (2009) found that the

value of proximity to greenway and parks increased over time, while the value of proximity to golf courses fell.

Schools are also a major influence on house prices, and studies have explored numerous aspects of this relationship. Des Rosiers et al. (2001) confirm the importance of size and proximity of primary schools to house values, and determined the optimal school size to be in the 300-450 pupil range and the optimal distance to be between 300 and 500 metres. Davidoff and Leigh (2008) and Ferrari and Green (2013) similarly found the strong influence of both primary and secondary school performance on house prices, which is also in line with school tuition costs. Additional aspects of house prices were tested by Zahirovic-Herbert and Turnbull (2008) who found that not only housing selling price but also housing marketability—as reflected by selling time or liquidity—are affected by changes in school quality. Decreasing school quality tends to result in lower marketability of housings in the vicinity. The findings imply that families with school-age children make more than one decision when it comes to home purchasing. Apart from the decision about housing investment, they also have to consider, at the least, the long-term costs of education embedded in house prices, which Zahirovic-Herbert and Turnbull (2008) referred to as human capital investment.

Living in close proximity to the CBD means residents gain from greater accessibility to employment opportunities. This is reflected in shorter commuting time as suggested by the Alonso-Muth-Mills theory. As residents move farther from the centre, they face higher commuting costs, which vary according to the slope of the bid-rent curve. A number of the aforementioned studies on the influence of urban rail transport have confirmed the increasing importance of the proximity to stations especially for housings closer to the CBD. Two empirical hedonic studies in China confirmed the theory. Chen and Hao (2008) asserts that housing prices in Shanghai vary according to price gradient, the pattern of which varies substantially in different directions from the CBD. In Chengdu, Zou (2015) discovered that housing prices decrease with distance from the CBD and walking distance from underground stations. He also noted the positive impact of larger floor space, good decoration and green space on prices. The findings are interesting in that larger floor space implies greater distance from the CBD, and this could confirm the bid-rent theory that housing prices drop at a decreasing rate with distance from the CBD—or it may be that certain housing submarkets exist, and price gradients differ from one submarket to another. In

this regard, the housing market may be considered a set of distinctive submarkets arising from structural and locational attributes (Adair et al., 1996). Zou's (2015) findings also suggest that property tax rates for units with a larger floor space should be higher than those for a smaller one.

Attributes considered to have negative impact on housing prices largely concern neighbourhood, area or urban form. Urban sprawl is often referred to as a negative attribute, but this may not be completely valid. In a hedonic price analysis, Kuethe (2012) found that spatial fragmentation and neighbourhood land use diversity in the city of Milwaukee have various impact on housing prices. At low levels of spatial fragmentation, there is a positive return to size of housings, yet housing values tend to be positively associated with spatial fragmentation at high levels. Other attributes considered to have definite negative impact on housing prices include proximity to places causing externalities and environmental hazards. Studies have attempted to quantitatively measure effective distance and price change as a result of negative impact. Cohen and Coughlin (2008) estimated that houses located in areas affected by airport noise pollution—as defined by a day-night sound level of 70-75 decibels—are normally sold 20.8 per cent less than unaffected houses. In a study of the negative effects of incineration plants in Hangzhou, China, Zhao et al. (2016) claim that the percentage decrease in initial listing prices of houses located within three kilometres of the plants is up to 25.9 per cent. The results are based on over 500 high-rise residential units. Similar measurements were performed by Brandt and Maennig (2012) on the proximity to cell phone base stations. They found that, in Hamburg, houses located within a radius of 100 metres of the stations were sold at a 5.2 per cent discount on average.

3.8 Reforming Property Tax

Property tax reform is often politically unpopular, but it is much needed in many countries. Many property tax systems have not been reformed for several decades, not because such a process is unnecessary but because it is difficult to carry out. What we will see in this section is the experience of some emerging economies in property tax reform attempts, from which analysis and recommendations are drawn. The reasons for undertaking property tax reform seem to vary from country to country, depending on the structure of property tax systems. Common rationales for reform are the requirements for higher tax yield, higher assessment accuracy and improvements in administration. (Bahl et al., 2010; Dillinger, 1991; Rosengard, 2012). However, several characteristics of property tax that are desirable in theory have often proved difficult to achieve in practice. This presents a profound dilemma for the reform of property tax, which Rosengard (2012, p. 2) calls 'the tax everyone loves to hate', and claims that:

- While the high number of statutory taxpayers creates a large tax base, a good thing in theory, it can be a political and administrative nightmare in practice;
- While the tax's high visibility is good for government transparency and accountability, heightened taxpayer awareness also tends to intensify taxpayer resistance;
- While computer-assisted mass appraisal and other applications of appropriate technology increase administrative efficiency and effectiveness, property valuation nevertheless still has a contentious subjective component;
- While the tax is seen as fair in general, there is no direct relationship between tax liability and ability to pay the tax, which leaves some taxpayers 'asset rich but cash poor';
- While the tax supports local government autonomy, it can also worsen regional disparities in wealth, as the 'rich get richer and the poor get poorer';
- While citizens might accept the tax in principle, there is still widespread resentment in some countries to enforcement

proceedings, sometimes seen as a threat to the sanctity of the home.

Property tax reform can take various forms: legal, assessment, rate, administrative, or a comprehensive overhaul covering all aspects of the tax. In general, however, reform can be categorised into two main approaches: data-led and collection-led (see Figure 3.1). The data-led approach focuses on the improvement of the property tax roll—i.e. identification and valuation, while the collection-led approach emphasises more on the administrative functions of the property tax system—i.e. assessment, billing, collection and enforcement (Rosengard, 2012). The latter approach is, however, claimed to be more successful in many countries, especially in emerging economies, because it encourages the facilitation of voluntary compliance (Franzsen and McCluskey, 2005; Kelly, 1995), and is less prone to be front-loaded with many financial and political costs (Rosengard, 2012).

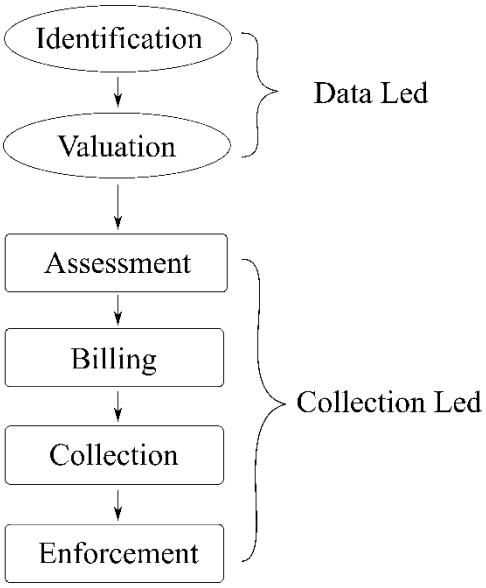

Figure 3.1 Approaches to property tax reform (Source: Rosengard, 2012, p. 11)

Moreover, it should be noted that, in this context, there is a clear distinction between ‘valuation’ and ‘assessment’. The valuation function, as part of the data-led approach, concerns the preparation of property tax rolls. This mainly includes official property records—i.e. cadastre, taxable status, valuation date, etc.—based on either jurisdictional or national assessment rules or both. In Thailand, for example, property tax rolls are based on national assessed values and rules, but are maintained by local governments. The assessment function refers to the process from which assessed values

are derived. Specifically, it is an approximation of property values to form a base for property taxation. The tax base is used by other functions including valuation and billing.

However, the structure of the data- and collection-led approaches must not be confused with the structure of property tax systems. The process flow of property tax systems differs from the diagram shown in Figure 3.1 in terms of sequences. Although it may appear that the valuation function is based on the assessment function, in reality they reciprocally benefit each other. Particularly in a centralised system, the assessment of property requires detailed and accurate valuations (property data records), and the accuracy of property tax valuations largely depends on the accuracy of assessments. The scope of the valuation function is in fact broader than that of the assessment function as it translates tax laws and regulations into actual implementation of tax rates, and calculates taxable values by incorporating them with assessments (tax base). The valuation function also includes the survey of property information such as land use, building type, road width, etc. Apart from property identification, all other functions rest upon the valuation and assessment functions.

3.8.1 A tale of two cities

Despite many challenges, property tax reform has in fact been a global phenomenon during the past three decades. In Asia, some of the early property tax reform attempts took place in the Philippines in 1972 and in Indonesia in 1986. In the Philippines, the Real and Property Tax Administration Project (RPTA) marks an important initiative for sustainable improvements in property tax administration through the application of low-cost mapping and assessment techniques. According to Dillinger (1988), the Philippines' solution for obsolete and inaccurate tax bases was the adoption of minimum standards for mapping and assessment. This involved the delineation of land parcels to a degree that could permit subsequent identification and to obtain area data needed for assessment. A simple mass appraisal technique was used to derive assessments from a small number of property characteristics.

The new system allowed the Philippine government to minimise the use of costly resources—i.e. experienced assessors, engineers and other technical personnel—by using local assessors/staff, newly engineering graduates and casual labour (Ibid.). Property tax revenue increased from 178 million pesos in 1972 to 270 and 385 million pesos in 1973 and 1974 respectively, and the proportion of property tax to total local

revenues increased from 13 per cent in 1972 to 17 and 20 per cent in 1973 and 1974 (Rosengard, 1997, p. 73). The reform effort was deemed successful in utilising low cost tools to achieve higher yield of local revenue through the improvement of property assessments and coverage. However, there has been a failure to sustain this level of revenue performance in the long run. The importance of property tax as a local revenue source reduced continuously from 23 per cent in the 1980s to 18 per cent in 1990 and 13 per cent in 2000 (Guevara, 2004). The proportion of real property tax to total tax revenue also decreased from 2.6 per cent in 1999 to 2.1 per cent in 2007 (OECD, 2020).

In Indonesia, an overhaul of the property tax system began with the introduction of the Land and Building Tax (Pajak Bumi dan Bangunan, or PBB) in 1986, as part of a comprehensive tax reform, to replace a complex tax system called Ipeda. The Ipeda system suffered from obsolete tax rolls based on ad hoc updating of property data, and disjointed property tax legislation consisting of seven different land tax ordinances with different and overlapping tax bases (Booth, 1974). Ipeda consolidated too many types of taxes ranging from agricultural produce to improved and unimproved land, making it a very complicated tax to administer and also generating equity and efficiency problems (Government of Indonesia, 1985).

The implementation of the Land and Building Tax (PBB) simplified the property tax system and broadened the tax base by curtailing inappropriate tax exemptions (Kelly, 1993). Immediately following the legal reform was a major administrative reform in 1988, which aimed at strengthening collection and enforcement. The reform resulted in a significant increase in property tax revenue from 16 per cent between 1984 and 1987 to 20 per cent between 1987 and 1990 (annually in absolute terms), but since then the growth rate reduced gradually to 8.5 per cent annually between 1996 and 1999 (Kelly, 1993, 2003). The increase in revenue mostly went to provincial government (level 1) rather than regional (sometimes referred to as local) government (level 2). It was evident that the proportion of provincial government's property tax revenue to total revenue increased from 2.1 per cent in 1987 to 10.8 per cent in 1999, while that of local governments remained the same at just above 10 per cent during the same period (Kelly, 2003). This enabled provincial governments to rely less on central government subsidy, which was reduced from almost 76 to 51 per cent during the same period (Ibid.).

The key difference between the two cases was that Indonesia adopted the collection-led approach while the Philippines was inclined more towards the data-led approach. What insights can we draw regarding which is the more effective approach, particularly for emerging economies? The growth in property tax revenue after the reform in Indonesia was indeed remarkable but evidence suggests that it was largely spurred by a rapid growth in the mining and urban sectors, from which property tax was collected by a small number of sub-national governments (Lewis, 2003). The revenue contribution of mining and urban sectors increased from 8 and 10 per cent of total revenues in 1969 to 55 and 22 per cent in 1991, while the revenue contributed by the rural sector declined from 75 per cent in 1969 to only 13 per cent in 1991 (Kelly, 2003, p. 1). The sectoral shift and the change in valuation system for mining-related properties have caused a spatial concentration of property tax revenues in Indonesia.

Furthermore, after the property tax reform in Indonesia, authority over major tax bases was retained by central and sub-national governments. Regional governments had, and still have, limited power over major and new tax bases, which means their property tax revenues vary significantly. Kelly (1993, p. 91) asserts that in 1990 an average collection per property in two of the largest cities—Jakarta and Surabaya—was 73,793 rupiahs, compared with an average of between 2,616 and 9,200 rupiahs per property for all other Indonesian cities. This reflects the problem of narrow and uneven geographical distribution of tax base. The collection-led strategy was mostly effective in areas where the payment point system (SISTEP)[4] was in place. The reform had almost no effect on the revenue structure of the regional governments, who still rely heavily on grants from the central government—i.e. almost 80 per cent of their total revenues (Kelly, 2003). A key takeaway from both cases is that a partial property tax reform can hardly generate sustainable revenue yield for the lowest tiers of government in the long run. Also necessary are the devolution of property tax, limitation of the central grant transfer system and improvement in transparency and public understanding.

[4] The payment point system or SISTEP is a collection system designed to simplify and facilitate property tax payment with pre-designated banks located near the tax object serving as payment points; uniform due date; pre-printed matching bills and receipts; stramlined records and reports; and a computer-generated delinquency list with which to initiate credible enforcement proceedings (Kelly, 1993; Rosengard, 1997, p. 111).

There is much discussion on the underuse of property tax potential (Dye and England, 2010; Engelmann et al., 2015; Government of the Philipines, 2019; McCluskey and Trinh, 2013). The devolution of property tax has been widely claimed to be a fundamental factor for a sustainable increase in local revenue generation. Engelmann et al. (2015) confirm that land and building tax revenues in Indonesia grew significantly between 2011 and 2013 when the decentralization of property tax collection took place, from 8.83 to 27.23 per cent annually (nominal). The basic conditions for maximising the capacity of recurrent property tax are the strength of human resources and ICT infrastructure (Engelmann et al., 2015; Gomez, 2010), the accuracy of property data and assessment, and a valuation system that is less rigid and more accountable (Government of the Philipines, 2019; Youngman and Malme, 2001). If these conditions are met it is likely that the devolution of property tax will strengthen local governments in terms of property tax collection.

3.8.2 Recommendations for reform

Potential results of a successful property tax reform are an increase in local revenue, an improvement in fiscal performance, and a reduction in inequities, as well as administrative and compliance costs in the tax system (Slack and Bird, 2014). However, in practice, it is unusual for property tax reform policies to achieve all of the above results. As we saw in the cases of Indonesia and the Philippines, no policy decision was able to improve the property tax system in all aspects. Policymakers are always faced with difficult choices of: which functions of the property tax system require the most attention; what is the appropriate sequence of policies; and when to implement each policy? The major causes of reform failure are limited resources and political resistance. For these reasons, the determination of appropriate reform strategies should be based on precise problem identification.

Table 3.4 Strategies for property tax reform

Issues and problems	Promising approaches	Problematic approaches
Salience:	Improvement in local services	Property tax capping
Property tax is highly visible	Increase payment options	Assessment limits
Liquidity constraints:	Tax deferrals for disadvantaged groups	Property tax capping
Tax burdens do not reflect the ability to pay	Phase-in	Assessment limits
Perceived regressivity:	Property tax credits	Banding assessment system
Higher tax on low-income householders	Tax deferrals	Assessment limits
Volatility:	More frequent reassessment	Property tax capping
Potentially large swing in tax burdens	Communication in understandable form	Assessment limits
Presumptive tax:	Efficient and accessible appeal process	Self-assessment system
Tax base is inherently arbitrary	Phase-in	Classified property tax rates
Inelasticity:	Improvement in tax zoning	Banding assessment system
Limited tax base (for local governments)	More frequent reassessment	

Source: Adapted from Slack and Bird (2014, p. 22)

As shown in Table 3.4, strategies for property tax reform can be divided into two main categories: economic and political. Economic reasons for reform stem from the inefficiency and inequity of property tax, which concerns tax structure. In this regard, the two important aspects are tax base and rate, as they directly affect local revenue and the distribution of tax burdens. For example, if tax base is defined by political boundaries, each local government tends to have access to a limited number of taxable properties, which may vary by type and value. One option for reform is to change tax zoning from a politically defined one to a system better suited to the size of tax base. Inequities in property tax systems can be improved by more frequent reassessment and appropriate design of tax rate structure. The more accurate the tax base, the more tax rate structure can work as it is intended to—i.e. progressive tax rates cause more progressive tax liability if imposed on accurately assessed prices than on regressive ones.

Political reasons for property tax reform often concern the visibility of property tax, which causes resistance from taxpayers and difficulties in improving the tax system. A key reform strategy is that local governments must ensure that tax revenue is efficiently spent, and that local expenditure is transparent. If the link between property tax and local benefits can be established, it is less likely that taxpayers will avoid payments. Moreover, local governments can increase payment options for property tax—e.g. online banking, direct debit, deduction at source, etc.—to make it more convenient for taxpayers. Improved payment methods will increase tax revenue and decrease administrative and compliance costs.

3.9 Conclusion

The range of literature reviewed so far has covered the functions of the property tax system and key concepts of equity in property taxation. The fact that the property tax systems are difficult to administer in practice and inherently unfair is perhaps inevitable, but the efforts to improve the systems can still benefit from the formulation of new theories and policies. This thesis has reviewed the evaluations of the property assessment system, the analyses of uneven distribution of tax incidence and inequities produced by anomalies in property tax systems. It has also reviewed the cases of the Philippines and Indonesia, which employed contrary approaches in property tax reform. Most of the literature has established firm foundations for the analysis of property tax in terms of ways to improve assessment processes, and the development of effective tax designs and tax administration. However, this research aims to contributes further by identifying the relationship between property assessment problems and spatial patterns of urban developments, particularly in areas where complex and diverse land uses are ubiquitous like Bangkok.

There are two important grounds on which property tax system can be evaluated: equity and efficiency. On the equity ground, tax incidence can be justified by the benefit and the ability to pay principle. On the efficiency ground, a tax system should be designed and operated in a way that minimises administration costs and economic distortions. However, the design of the property tax structure is complex due to certain characteristics of the property themselves. Properties can be either wealth, investment or production factors, depending on how they are utilised. As property tax is collected from the stock of estimated values, there needs to be standardised, fair systems of value assessment in place. Therefore, this thesis mainly focuses on the equity aspect of the property tax system. The ability to pay principle mentioned in Chapter 2 has been at the centre of the analysis in this chapter. The criteria for the ability to pay is, however, not the income of property owners but the market value of property.

Regarding the analysis of property tax incidence, there are three issues that need to be considered carefully. First, to justify geographic and demographic distributions of property tax burdens, we should establish a clear understanding of the relationship between property values, household characteristics and urban development patterns. Second, assessment quality is a pressing issue that has direct impact on fairness and equity in most property tax systems. Vertical and horizontal equity remain the key

analytical frameworks in this regard. Vertical inequities arise when tax liability for owners of higher priced properties are lower than those of lower priced properties, which is often the case with under-assessed properties and in the absence of progressive tax rates. Horizontal inequities arise when owners of properties with similar values have different tax liability. The primary cause for this problem is assessment inaccuracy. Lastly, the identification of assessment bias at neighbourhood levels can contribute to the rectification of common inaccuracies in assessment systems. Property assessment accuracy matters because it directly affects tax liability of property owners/occupiers. The literature suggests that the analysis should be carried out comprehensively at both global and local levels for the results to be meaningful. If assessment problems can be detected at neighbourhood levels, it is more likely that assessment systems can improve faster.

Tax reform is inevitable in any attempt to make property tax systems more efficient and equitable. Property tax reform in practice has been proved difficult in many countries as it is often politically unpopular. There are good economic and political reasons for reform, each of which requires different strategies. As the two examples showed, when property tax reforms are carried out properly, the results are very significant improvements in revenue generation and tax base expansion. Property tax reforms may be data- or collection-led, and the literature indicated that the latter approach is more efficient as in the case of Indonesia. In essence, for appropriate reform strategies to be formulated, it is important that local governments are aware of the nature of the tax base in their jurisdictions—i.e. property type and value compositions—and make every effort to ensure that tax administration is transparent. Economic reasons for tax reform are largely associated with the improvements of tax assessments. Without an accurate tax base, it is difficult to achieve progressive distribution of tax burdens even though tax rates are progressive.

In the following chapter we will introduce the case study area of Bangkok and discuss the political and tax systems in Thailand. Bangkok is the capital of Thailand and it is by far the biggest and most populated city in the country. Its urban structure and land uses are complex and not ideally organised, which makes it an interesting case study.

Chapter 4 Case Study Area

This chapter provides the background to the empirical study of this research. The first section discusses the structure of local authorities in Thailand, which are the collectors of property tax. Section 4.2 gives an overview of the geographical features of Bangkok and the patterns of urban transport infrastructures. Section 4.3 explains the structure of the tax system in Thailand, followed by a narrative on property tax evolution in Thailand from Section 4.4 to 4.5. Finally, in Section 4.6, the chapter concludes with analysis of the assessment practice in Thailand, which forms a fundamental part of the Land and Building Tax base.

In discussing Thailand's property tax system, this thesis focuses on the residential property market in Bangkok, which represents the ubiquitous spread of various patterns of land use and neighbourhood quality. Under the previous property tax system in Thailand, residential properties were liable to two types of recurrent property taxes: the Building and Land Tax and the Council Tax—which some writers refer to as 'Land Development Tax'. Building and Land Tax is imposed on the actual rental value of investment properties (rental housing) and covers the values of both land and improvements. The tax was collected annually at the rate of 12.5 per cent of the gross rental value. The Council Tax is based on assessed value of land (also known as 'medium value') without any account being taken of improvements thereon. The new tax, called Land and Building Tax, has been used in place of the two recurrent property taxes. It is specifically designed to be more comprehensive in terms of tax base, in which all types of land uses will be included, and to be more complex in terms of tax rates, which differ by property types.

4.1 Public administration in Thailand

Thailand is organised into 76 provinces and two special administrative regions (BMA and Pattaya City). Prior to a reorganisation in 1999, Thailand maintained a centralised administrative system in which the government was divided into three management levels: central, provincial, and local administration. However, after the implementation of the 1997 Constitution and the 1999 Decentralisation Act, Thailand saw a major structural change to local government, which resulted in a two-tier public administration system that consists of central and overlapped structures of local governments.

At the local level, there are two seemingly parallel systems: provincial and local administrations (see Figure 4.1). At the lower administrative level, the two systems differ in terms of management, as the local administration has more autonomy than the provincial administration. At the executive level, however, the administrative power of both systems seem to be strictly limited by the central government through governing bodies of the Ministry of Interior (Department of Local Administration, 2016). As of 2016, there are 14,557 local authorities, of which the number of local administration exceeds that of provincial administration because the sub-district administrative organisations (SAOs) also have offices located in small towns (see Table 4.1 for details).

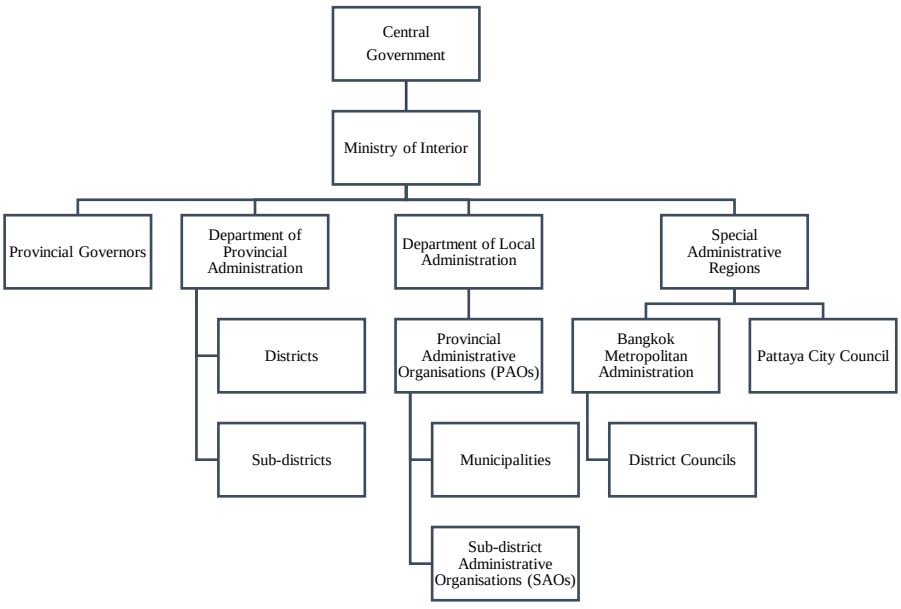

Figure 4.1 Local administration structure in Thailand (Source: Department of Local Administration, 2016)

Table 4.1 Local authority in Thailand

Local Administration	
Provincial administrative organisations (PAOs)	76
Municipalities	2,440
Sub-district administrative organisations (SAOs)	5,335
Special administrative regions	2
Total	7,853
Provincial Administration	
Provincial governors	76
Districts	878
Sub-districts	5,770
Total	6,724

Source: Department of Local Administration (2016)

In the provincial administration system, the central government has branch offices at provincial, district and sub-district level. Provincial governors are appointed by the cabinet to serve as representatives of the central government. The district and sub-district offices are administered by appointed representatives (from the Ministry of Interior) who are responsible for the delivery of centrally administered services and the provision of certain functions such as disaster management and local economic development. However, they do not have authority over property tax administration.

In the local administration system, each province has one provincial administrative organisation (PAO) and a number of municipalities and sub-district administrative organisations (SAOs) depending on their population size/density and revenue raising capacity. Municipalities are generally bigger and more densely populated than SAOs, and usually located in the town centre of each region. All of these local authorities have directly elected councils and executive committees, and indirectly elected council chairs. Additionally, BMA and Pattaya City are the two special administrative regions that have their governors elected every four years.

According to the Decentralisation Act 1999, local administrative organisations (LAOs) play an important role in delivering local services (over 150 functions). LAOs operate under either a one-tier system (BMA and Pattaya city council) or a two-tier system (PAOs, municipalities and SAOs). At every tier, there is a division of the legislative function from the executive function. At all levels (provincial, municipality and sub-district), every local authority has a panel of councilors who are responsible for enacting bylaws and electing a chief executive. This distinction has given the local authorities in the one- and two-tier systems more administrative power and autonomy than those authorities under the Department of Provincial Administration.

However, the coexistence of PAOs and LAOs leads to costly administration and inefficient management (World Bank, 2012). In practice, relations between provincial and local government are complex and confusing due to the overlapping supervising and financing roles of both institutions. For instance, despite LAOs having the authority to plan their own budget, an approval from the provincial government is still required. However, the case of BMA is dissimilar in that it is a special administrative organization, which has more power over funds and resources.

4.2 The Geography of Bangkok

Bangkok Metropolitan Region (BMR) refers to BMA and its surrounding provinces: Pathum Thani, Samut Prakan, Samut Sakhon, Nontaburi and Nakhon Pathom. 'Bangkok' in this study refers to BMA, which is governed by Bangkok Metropolitan Administration (shown in Figure 4.2 and 4.3). Bangkok is the capital and the most populous city of Thailand. The city encompasses a total area of 1,583 square kilometres. The main topographical feature of Bangkok is the Chao Phraya River which crosses the city from the north to the southeast. The east side of the river is called 'Phra Nakhon' and the west side is called 'Thon Buri'.

Bangkok Metropolitan Administration is a special administrative organisation that overlooks 50 boroughs of Bangkok (BMA). The largest borough is Nongjok (number 3 in Figure 4.2), which lies to the east of Bangkok covering an area of 236.26 square kilometres, and the smallest borough is Sampanthawong (number 13 in Figure 4.2), which lies at the heart of the old town on the east bank of the river covering an area of 1.42 square kilometres. Bangkok has long been the centre of what Gugler (1996) describes as 'temporary migration'. People from other provinces and neighbouring countries migrate to Bangkok for employment opportunities but still have strong bonds with their families back home, which makes Bangkok one of the busiest cities in Southeast Asia. Various types of land use and complex residential zones within Bangkok make it an ideal case for testing spatial distribution of housing prices.

The east bank of the river is, for the most part, more developed than the west bank. The CBD, major shopping centres, and most political and important institutions are all located in the east side of Bangkok. Most of them are concentrated in the six following boroughs: Phra Nakhon, Pom Prap Sattru Phai, Samphanthawong, Pathum Wan, Bang Rak and Sathorn (number 1, 8, 13, 7, 4 and 28 in Figure 4.2 respectively). There are two international airports. Opened in 1914, Don Mueang is Bangkok's first international airport situated in the northern suburbs of BMA. The airport is on the main road connecting to the highway that leads to the northern provinces. In 2006,

Suvarnabhumi International Airport (situated to the southeast of Bangkok in Samut Prakan) began to operate with a higher capacity for flights and passengers.

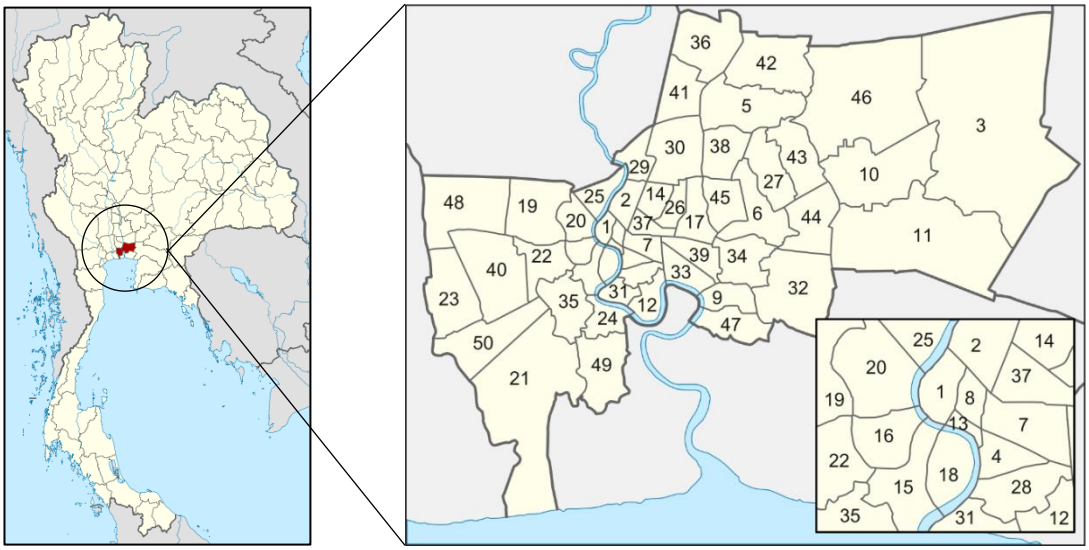

Figure 4.2 Location of Bangkok (BMA) and its boroughs (Source: BMA, 2017b)

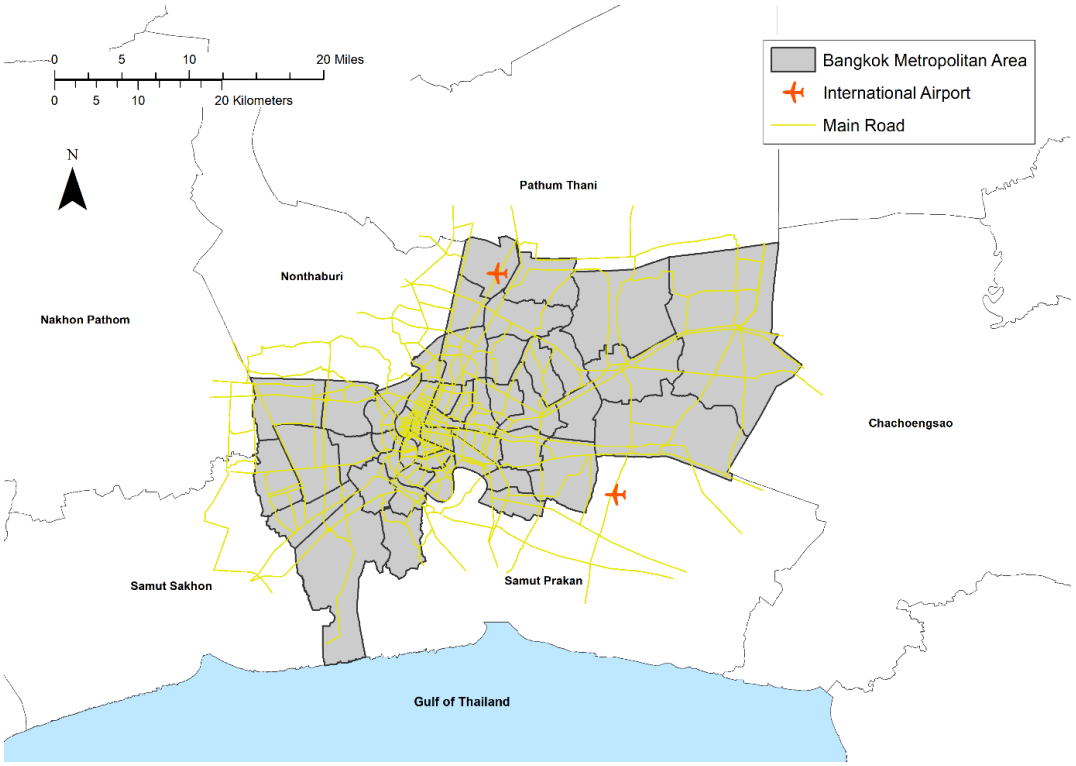

Figure 4.3 Bangkok Metropolitan Area (BMA) and its surrounding provinces

In the past, Bangkok was a canal and river city. Waterways had been the main means of transport until the early 1850s when the government implemented modernisation programmes which emphasised expanding the road network (Bae and Suthiranart, 2003). Since 1960, as a result of continuous rural-urban migration, inexorable rise in car ownership and fragmented configuration of the road network, Bangkok has faced with serious traffic congestion. Canals were filled to facilitate further expansion of the road network. Between 1980 and 1990, when canal filling could no longer help reduce traffic congestion, the government approved the construction of the expressway system. During the sixth National Economic and Social Development Plan (1987-91), more than half of public investment in solutions for traffic and transportation problems was spent on the construction of the expressway system (NESDB, 1987).

While sizeable funds had been invested in road infrastructure, urban rail transport did not receive much attention from the government (before the late 1990s). Prior to that period, State Railway of Thailand (SRT) had operated on very few routes and stations, and the trains ran infrequently. In 2000, the first two lines of Bangkok Mass Transit System (BTS) or 'sky train' were introduced (part of the dark and light green lines in Figure 4.4). The BTS is a faster, more frequent and more punctual elevated urban rail service. In 2006, the first line of underground train (Metropolitan Rapid Transit—MRT) began to operate (part of the blue line). Together, these three city rail transport routes are 34.5 kilometres long, and run from the centre to the north (Phya Thai, Chatuchak and Bang Sue), to the south (Phra Khanong and Bang Na), and to the west just across the river (Klong San). In 2010, the Airport line began to operate, which linked Suvarnabhumi Airport and several eastern suburbs to the heart of Bangkok (Phya Thai station). It takes 30 minutes (6 stops) to travel from Suvarnabhumi Airport to downtown, compared to 45-60 minutes travel time by car. The four lines give access to and between commercial downtown areas and a few suburbs, but have neglected significantly populated residential areas of Bangkok.

Later in 2016, part of the purple line was opened to cover another 23 kilometres (16 stations), connecting the old town area (Hua Lamphong and Chinatown) to the northern borough of Bang Sue. The rest of the urban rail transport lines shown in the map are still under construction (due to open between 2020 and 2023) including the line that

connects to Don Mueang Airport, and some elements are still in the pipeline (the yellow and brown lines, not shown in the map).

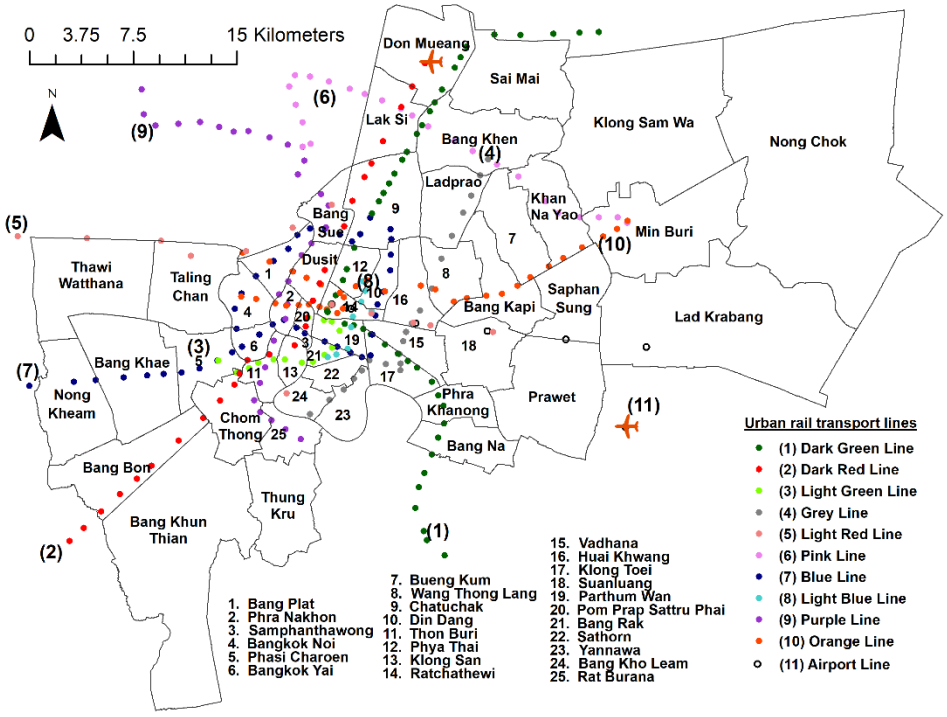

Figure 4.4 Locations of completed urban rail transit stations in Bangkok

Table 4.2 shows detailed characteristics of all 50 boroughs of BMA. Overall, the smallest borough, Samphanthawong, with an area of 1.39 square kilometres, is the most densely developed area. The development density in Samphanthawong is 5,302 units per square kilometres, which is 35 per cent higher than that of the second most densely developed borough, Pom Prap Sattru Phai, with the figure of 3,450 units per square kilometres. 20 out of the 50 boroughs have a property density higher than BMA's average of 1,997 units per square kilometre, and 15 of those are located on the east side of the river. Pom Prap Sattru Phai and Samphanthawong are also the most densely populated boroughs, with a population density of just over 20,000 residents per square kilometre. At the other extreme, the least densely developed and populated boroughs are Nong Chok and Lad Krabang, both of which are located on the eastern fringe of the city. The number of property units in Nong Chok, for example, is only 8 per cent of that in Samphanthawong.

Table 4.2 Details of 50 boroughs of BMA

Borough	Area (km^2)	No. of residents	No. of community	No. of public school	Population density (persons/km^2)	No. of property	Property density (units/km^2)
Bang Bon	35.86	104,768	11	8	2,922	51,629	5,302
Bang Kapi	27.59	148,645	28	11	5,388	55,946	3,450
Bang Khae	47.89	192,276	47	12	4,015	87,394	3,220
Bang Khen	40.96	188,252	74	5	4,596	80,440	3,159
Bang Kho Leam	8.31	96,422	29	7	11,600	22,910	3,029
Bang Khun Thian	122.21	161,642	49	16	1,323	96,650	2,991
Bang Na	18.95	97,039	40	7	5,121	31,775	2,965
Bang Plat	11.80	100,319	46	11	8,498	27,619	2,913
Bang Rak	4.01	46,087	16	5	11,486	12,922	2,845
Bang Sue	12.89	135,001	50	7	10,477	36,662	2,756
Bangkok Noi	12.32	120,032	43	15	9,740	33,568	2,724
Bangkok Yai	6.30	73,864	34	6	11,728	18,836	2,587
Bueng Kum	23.40	146,197	41	8	6,246	60,545	2,536
Chatuchak	32.66	161,409	41	7	4,943	55,058	2,495
Chom Thong	23.17	158,646	53	11	6,848	51,674	2,435
Din Dang	8.47	131,847	22	3	15,574	26,746	2,340
Don Mueang	36.69	166,210	81	6	4,530	58,269	2,244
Dusit	11.33	108,815	45	9	9,604	8,893	2,230
Huai Khwang	16.32	77,720	25	3	4,762	27,201	2,202
Khan Na Yao	25.38	87,169	39	2	3,434	42,172	2,028
Klong Sam Wa	120.18	165,352	73	18	1,376	102,160	1,964
Klong San	5.97	77,471	44	7	12,986	17,687	1,948
Klong Toei	13.24	110,481	41	4	8,344	17,369	1,921
Lad Krabang	128.63	160,850	60	20	1,251	83,074	1,908
Ladprao	21.27	122,180	32	6	5,745	53,070	1,825
Lak Si	22.67	111,120	73	6	4,902	43,552	1,779
Min Buri	61.12	136,236	62	13	2,229	58,786	1,758
Nong Chok	240.45	154,371	87	37	642	107,208	1,753
Nong Kheam	36.20	148,298	71	6	4,096	61,343	1,744
Parthum Wan	8.03	54,996	16	8	6,846	5,880	1,694
Phasi Charoen	19.18	130,493	54	13	6,803	43,050	1,686
Phra Khanong	13.58	94,482	45	4	6,958	33,064	1,677
Phra Nakhon	5.36	58,771	21	11	10,963	11,804	1,667
Phya Thai	9.21	73,533	29	1	7,980	16,151	1,662
Pom Prap Sattru Phai	2.50	52,093	15	4	20,803	8,639	1,634
Prawet	53.73	158,457	41	16	2,949	77,667	1,588
Rat Burana	12.33	87,841	28	6	7,122	21,681	1,568
Ratchathewi	7.17	72,900	25	4	10,171	12,500	1,539
Sai Mai	43.61	185,987	69	9	4,265	77,596	1,487
Samphanthawong	1.39	28,001	19	3	20,102	7,385	1,446
Saphan Sung	28.07	88,918	28	6	3,168	44,017	1,440
Sathorn	7.26	86,214	25	2	11,877	21,147	1,312
Suanluang	24.11	115,419	46	8	4,786	45,998	1,167
Taling Chan	35.77	106,786	43	16	2,986	53,193	962
Thawi Watthana	51.73	75,460	13	6	1,459	60,372	850
Thon Buri	8.46	121,539	45	17	14,363	25,632	791
Thung Kru	32.95	115,823	30	8	3,515	50,706	785
Vadhana	13.00	80,847	17	8	6,221	25,315	732
Wang Thong Lang	17.08	115,083	19	3	6,740	43,312	646
Yannawa	12.50	82,481	22	6	6,596	20,429	446
Total	1,583.26	5,674,843	2,007	435	-	2,136,696	-

Source: BMA (2017a)

4.3 Overview of the Tax System in Thailand

The Thai government's tax receipts were £60.51 billion in the 2017 fiscal year (October 2016 - September 2017), which is equivalent to about 20 per cent of the GDP. The majority of tax revenue is collected by the Revenue Department, which accounts for about 69 per cent of the total government receipts. Value added tax (VAT), corporation tax and income tax are the top three contributors of the government revenues. The revenues collected by the Excise and Customs Department altogether contribute another 20 per cent to the total receipt. The rest of the revenue comes from fees levied by other departments, as well as from state enterprises (see Table 4.3).

In general, the government relies on very few types of tax. Figure 4.5 shows the top three contributors of tax revenue from 1997 to 2017, all of which were collected by the Revenue Department. First collected in 1992, VAT has gained in importance over time despite the relatively low fixed rate of 7 per cent. In 2017, VAT accounted for nearly one-third of the total revenue, a similar proportion to that collectively contributed by corporation tax and personal income tax. The gap between corporation tax and personal income tax revenue has widened significantly as a result of narrow personal income tax bases as well as an extensive use of tax credits to stimulate domestic consumption.

In terms of tax distributions, the majority of the receipts from VAT, personal income tax and corporation tax are contributed by taxpayers in Bangkok. Between 1997 and 2017, taxes collected from businesses and individuals in Bangkok comprise about 65 per cent of the total income tax receipts, which leaves the portion of only about one-third of receipts contributed by taxpayers from the rest of the country (Department of Revenue, 2017).

The local taxes account for about two per cent of the total government receipts. All of these taxes are collected by LAOs (including special administrative organisations). At the provincial level, PAOs levy taxes on petrol stations, hotels, fishery and tobacco sales, and impose fees/charges on alcohol licenses, gambling licenses, mineral and petroleum royalties and parks and recreation fees. At the city and town levels, PCCs and SAOs levy Property and Land Tax, Council Tax, Signboard Tax, Slaughter Tax, Swallow Bird's Nest Duty, and impose fees/charges on parking and several licenses.

Decentralisation reforms have failed to establish a system that can promote local tax autonomy due to inefficient tax administration systems and obsolete local tax

legislation. Therefore, on the revenue side, LAOs have been subsidised a large share of their income by the central government. Between 2015 and 2017, the amount of central government subsidy was about 36 per cent of the total income of local governments; and about £5.4 billion, or 11 per cent of the central government's receipts, was spent as a subsidy every year (Fiscal Policy Office, 2017).

Table 4.3 Sources of Thai government revenue, fiscal year 2017 (Oct 2016-Sep2017)

Tax Types	Revenue (£million[5])	Percentage of total revenue
Revenue Department		
Value added tax	16,491.28	27.25%
Corporation income tax	13,127.54	21.69%
Income tax	7,002.15	11.57%
Petroleum revenue tax	875.14	1.45%
Specific business tax	1,136.32	1.88%
Revenue stamp	289.78	0.48%
Other taxes	11.04	0.02%
Excise Department		
Fuel duties	4,473.02	7.39%
Tobacco duties	1,524.51	2.52%
Alcohol duties	1,392.38	2.30%
Beer duties	1,937.69	3.20%
Vehicle excise duty	2,271.02	3.75%
Beverage duties	345.22	0.57%
Electronic device duties	0.11	-
Motorcycle duties	76.38	0.13%
Battery duties	54.11	0.09%
Other duties	29.64	0.05%
Customs Department		
Import customs	2,048.36	3.39%
Export customs	1.98	-
Other customs revenue	74.29	0.12%
Other Receipts		
Other departments	3,513.71	5.81%
Treasury department	230.78	0.38%
Revenue from state enterprises	3,605.91	5.96%
Total Receipts	**60,512.37**	**100%**

Source: Ministry of Finance (2018)

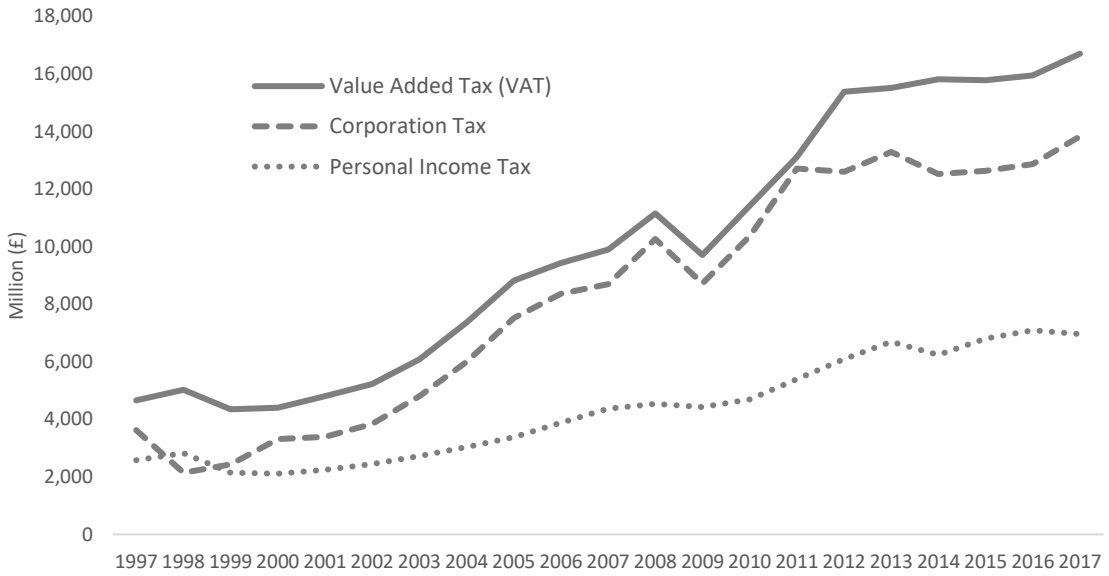

Figure 4.5 Top three contributors of Thailand's tax revenue, 1997-2017 (Source: Ministry of Finance, 2018)

[5] 45 baht = £1

4.4 Property Taxation in Thailand

In Thailand, property tax consists of two distinct areas: taxes on occupancy and taxes on transfers. Taxes on occupancy include Building and Land Tax and Council Tax, both levied by local governments (LAOs) at centrally determined bases and rates. Taxes on transfers include SDLT and IHT, which are collected by the central government (Department of Revenue).

Taxes on occupancy are an essential part of locally collected tax bills. However, due to the lack of appropriate enforcement systems and extensive tax exemptions, they are incapable of sufficiently financing local governments. Building and Land Tax is collected from the rental value of all types of investment properties, which include not only residential but also industrial and commercial properties. The tax is collected at a flat rate of 12.5 per cent. First introduced in 1965, the Council Tax has been collected from occupied land, whether it is owner-occupied or not. Under a regressive structure, a number of different tax rates are applied depending on the banding of 1978 assessments.

Moreover, there are two types of taxes paid upon transfer. First, the SDLT is a non-progressive tax collected from property transactions. The single flat rate of two per cent is payable on the entire transaction price. Second, the IHT, established in 2015, is charged on asset transfers that exceed the total value of 100 million baht (about £2.22 million). Though IHT is designed to target real estate transfer, any bequest of financial assets and vehicles must be included in the tax calculation as well.

4.4.1 Taxes on Occupancy

In Thailand, taxes on occupancy are recurrent and based on both land and improvements. There is no clear differentiation between residential and non-residential properties. The only distinction is between rental and owner-occupied properties. Rental properties are liable to Building and Land Tax and owner-occupied properties are liable to Council Tax. These two taxes on occupancy are central to the discussion in this thesis.

4.4.1.1 Building and Land Tax

All of the LAOs except PAOs are in charge of the collection of Building and Land Tax in their respective jurisdictions. Taxable property comprises residential, commercial

and industrial buildings and the land appurtenant thereto. Exemptions are applied to owner-occupied houses, royal palaces, government and state enterprise property, religious property and buildings that are unoccupied for one year or longer.

Tax base is calculated from either actual or imputed rental value of the taxable property by self-declaration system. Under the Building and Land Tax, imputed rent is called annual value, which is established by the Ministry of Interior as a prescribed percentage of the capital value of the property (Varanyuwatana, 2004). Local authorities are responsible for tax audit—e.g. building type determination and annual value estimation. Tax rate is proportional, specified at the flat rate of 12.5 per cent of the gross rental income or annual value (before expenses). The rate is reduced to one-third of the annual value for factories to which machinery is attached.

Criticism of this tax often focuses on the imposition of high tax rate on the gross rental income, which is also liable to personal income tax and corporation tax (Ngamarunchote et al., 2012). The tax structure should have substantially contributed to the tax receipts, but the current tax base is not wide enough to raise sufficient revenue for local governments. In addition, the legislation does not clearly describe the types of buildings that are liable to the tax. This loophole causes interpretation problems and encourages corruption. For instance, most LAOs often underestimate payable taxes to gain, or at least to keep, their popularity for upcoming elections. In practice, LAOs have very little incentive to maximise their tax receipts due to the huge sum of subsidies they receive from the central government every year.

4.4.1.2 Council Tax

The Council Tax in Thailand is a form of LVT. Taxable property comprises not only land but also mountains and water basins. All individuals and corporations who are in possession of lands are liable to pay the tax. Subject to certain geographical areas, lands used for residential and agricultural purposes are exempted from the tax, as is government and religious land. Exemption for residential property varies by density of population in the area: the more densely populated the area is, the fewer exemptions are applied. For example, in some central districts of Bangkok, residential property with an area of 400 square metres or less is excluded from the tax while in suburban districts the maximum area exemption is 8,000 square metres.

Based on an assessment of 1978 market values, Council Tax is collected from land values without any improvements thereon taken into account. All types of private lands are assigned to one of thirty-four bands, with the lowest value properties assigned to band 1 and the highest value properties assigned to band 34. However, tax exemptions are applied to the majority of land parcels throughout the country, which causes the tax base to be very narrow. The exemptions are applied according to the size of taxable land based on minimum areas, which are larger than an average land parcel size in Bangkok. Another problem lies with regressive tax rates since properties in the five highest bands are liable to lower tax rates than those in the middle bands. As shown in Figure 4.6, properties in bands 7-29 are liable to the highest rate of 0.5 per cent while higher value properties in bands 30-34 are liable to much lower rates.

Not only does the Council Tax fail to reflect actual worth of properties but also performs as a poor source of revenue for local authorities. The outdated assessment and value bands cannot be changed according to local governments' needs. In 2017, only two per cent of LAOs' total revenue came from the Council Tax while the subsidy from central government accounted for over 63 per cent. In addition, the narrow council tax base creates economic distortions and undermines the accountability of local authorities to their residents. The extensive exemptions of council tax were initially designed to limit tax burden on the poor but these have not been revised since the Council Tax Act came into effect in 1965.

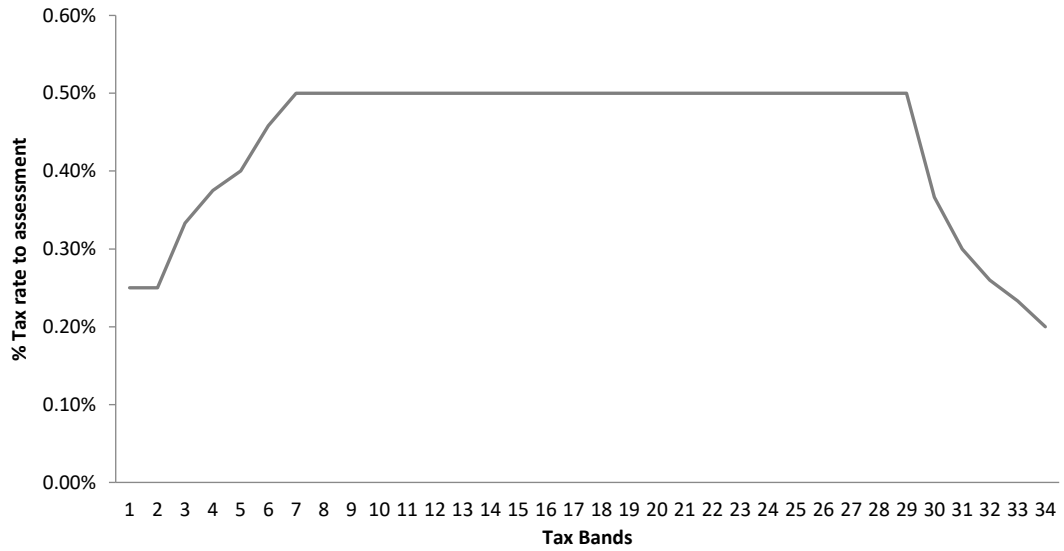

Figure 4.6 Council Tax rates as a percentage of 1978 assessment
(Source: Derived from the Council Tax Act 1965)

4.4.2 Taxes on Transfer

Although not directly relevant to this study, the property taxes on transfer in Thailand are still worth mentioning briefly. The two following taxes serve as important fiscal and political instruments for the government. However, they do not generate consistent income compared to other taxes and fees.

4.4.2.1 Stamp Duty Land Tax (SDLT)

The SDLT is a one-time transaction tax imposed at a fixed rate of two per cent of the transaction price, plus an additional one per cent for mortgage transactions. Revenue from the SDLT is unstable for two main reasons. First, the government is prone to use the SDLT as an economic stimulus via tax rate cut. The residential rate has been occasionally reduced to 0.01 per cent to stimulate demand in the owner-occupied housing market. The other reason is that the tax revenue depends on the number and value of property transactions each year, which tend to vary according to economic cycle.

In addition, there is no system to regulate declarations of actual buying/selling prices as transactions are usually completed without the involvement of solicitors/agencies. In this regard, the official assessments have been carried out by a government agency called the PVB to serve as minimum values for tax assessment. In Bangkok, every private property has its assessed price prepared in advance and reassessment is carried out every four years (the same assessed prices referred to in this study).

4.4.2.2 Inheritance Tax (IHT)

First implemented in January 2016, the IHT is levied on three main types of assets: real estate, financial and vehicular. Any transfer of assets exceeding 100 million baht (£2.2 million) is liable to the collection of the IHT at a flat rate of 5 per cent (for related individuals) and 10 per cent (for unrelated individuals) of the transfer amount that exceeds the minimum value. Any transfers below the minimum value are exempt from tax. The transfer between married couples is entirely excluded from the IHT. For the transfer of property and land, the IHT shares the same assessment database as the SDLT, which contains values that are arguably much lower than market values. Furthermore, the system by which the tax is collected does not do much to deal with

rising inequality. The minimum taxable value was set very high with a single flat rate instead of progressive rates that could be collected from many bands of values.

4.5 Attempts at Property Tax Reform in Thailand

Thailand adopts two assessment systems: value-based and cost-based. The property assessment database provided by the PVB consists of two parts: land values and average building construction costs. Assessed land values are calculated using market price comparison approach while building assessments are based on cost approach. Nonetheless, both values are just rough estimates and lack accuracy for two important reasons.

First, market sale data contain property value as a whole (including land and building) but the land assessment process requires the building values to be deducted from the total transaction values. The building values are calculated using mean building costs adapted from those of the Engineering Association of Thailand, which are the costs required in order to construct new buildings subtracted by depreciations (if any). Second, the assessed building values are calculated from average construction costs of several building types. The value is then added to the land value to yield the taxable value of the whole property.

The second reason is that, in Thailand, legislation relating to the Council Tax and the Building and Land Tax has not been updated for 80 years. The two taxes are incapable of generating consistent and sufficient revenues for local governments because of outdated tax rates and bases. Therefore, local governments have to rely heavily on central government's subsidy, which in turn limits their level of autonomy. In 2017, only around 17 per cent of BMA's revenue was financed by the property taxes (Fiscal Policy Office, 2017). Moreover, the SDLT is not a stable income source due to cuts in tax rates and fluctuating volumes of property transactions, and local governments have no control over the collection or allocation of the tax.

Accordingly, there have been many attempts at property tax reform which have aimed to create a new type of property tax on occupancy that could better serve as a revenue generator for local governments and as a more efficient fiscal instrument to tackle income distribution problems. The most prominent reform effort occurred in 1994 when the Democrat government proposed the first land and building tax Bill. The Bill has been revised several times during the past twenty years. In 2015, the junta proposed a new Land and Building Tax Bill, which was passed by the House of Lords in 2019 and will become effective in 2020.

4.5.1 Land and Building Tax

The Land and Building Tax seeks to eliminate the shortcomings of the previous recurrent occupancy taxes. It is specifically designed to strengthen local governments by generating higher self-collected revenues, and encourage more efficient land use by taxing vacant, underutilised lands at the highest rate. The Land and Building Tax Bill had gone through further amendments over the past five years than it ever has before. The final Bill was eventually approved by the Cabinet in March 2017, and in March 2019 the act was introduced and will come into effect on 1st August 2020.

According to the Land and Building Tax act, both land and improvement are taxed based on the assessments of the PVB. As previously mentioned, land is assessed by market comparison method while buildings are assessed by cost method (from average construction costs). The total property assessed value is simply the sum of these two assessments. The assessment processes have not involved property rental values as they require more time and manpower to gather.

The Land and Building Tax rates vary by property class and type of land use. Undeveloped land is taxed at the highest rate of 1.2 per cent, subject to 0.3 per cent increase every three years until reaching a 3 per cent ceiling. Commercial and industrial properties are similarly treated, being taxed at the same rate of 1.2 per cent. Residential properties are taxed at 0.3 per cent and agricultural lands are taxed at the lowest rate of 0.15 per cent. However, a tax relief scheme will be applied during the first two years of the introduction of the tax, in which tax rates of all classes of property are differentiated according to assessed value ranges.

In addition, there is also a three-year tax reduction scheme, becoming effective between 2020 and 2022, to target payers of the two previous property taxes (the Building and Land Tax and the Council Tax). In this tax relief scheme, if the amount of the Land and Building Tax payable is more than the amount previously paid for either of the previous two property taxes, property owners only need to pay the previous amounts plus 25 per cent of the difference in 2020, 50 per cent in 2021, and 75 per cent in 2022. There are also permanent tax exemptions applied to residential and agricultural properties with assessed values less than 50 million baht or £1.11 million (see Table 4.4)

Table 4.4 Land and Building Tax rates in Thailand

Property class	Tax base	Assessed value (Thai baht)	Tax rate	Exemption/Reduction
Vacant land	Land	Calendar year: 2020-22 Not over 50m Over 50m – 200m Over 200m – 1,000m Over 1,000m – 5,000m Over 5,000m Calendar year: 2023 onwards Rate for each value range increases by 0.3% annually	 0.30% 0.40% 0.50% 0.60% 0.70% 3.00%	Tax relief scheme applied during 2020-22, then in the third consecutive year of no development a single rate of 1.2% applied and will be increase by 0.3% every three years until reaching 3% ceiling.
Commercial and industrial	Land and improvement	Calendar year: 2020-22 Not over 50m Over 50m – 200m Over 200m – 1,000m Over 1,000m – 5,000m Over 5,000m Calendar year: 2023 onwards Single rate applied	 0.30% 0.40% 0.50% 0.60% 0.70% 1.20%	None
Residential (owner-occupied)	Land and improvement	Calendar year: 2020-22 Not over 25m Over 25m - 50m Over 50m Calendar year: 2023 onwards Single rate applied	 0.03% 0.05% 0.10% 0.30%	- Owner-occupied homes (lands and improvements) with assessed values not over 50m baht are exempted from the tax. - Owner-occupied improvements with assessed values not over 10m baht are exempted from the tax.
	Improvement (condominium)	Calendar year: 2020-22 Not over 40m Over 40m - 60m Over 60m - 90m Over 90m Calendar year: 2023 onwards Single rate applied	 0.02% 0.03% 0.05% 0.10% 0.30%	
Residential (non-owner occupied)	Land and improvement	Calendar year: 2020-22 Not over 50m Over 50m - 75m Over 75m – 100m Over 100m Calendar year: 2023 onwards Single rate applied	 0.02% 0.03% 0.05% 0.10% 0.30%	None
Agricultural	Land and improvement	Calendar year: 2020-22 Not over 75m Over 75m – 100m Over 100m – 500m Over 500m – 1,000m Over 1,000m Calendar year: 2023 onwards Single rate applied	 0.01% 0.03% 0.05% 0.07% 0.10% 0.15%	Agricultural lands with value not greater than 50m baht

Source: Summarised from the Land and Building Tax Act (2019)

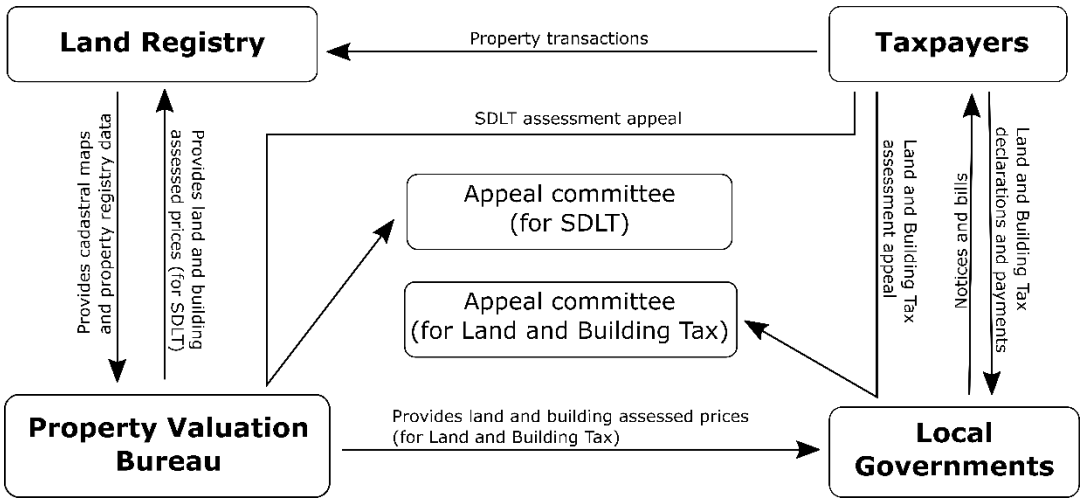

Figure 4.7 Property tax systems in Thailand

The property tax systems in Thailand are illustrated in Figure 4.7. Land and building assessed price provided by the PVB is used in both the Land and Building Tax and the SDLT. The assessed price was originally used only for the SDLT, but after the recent property tax reform the government decided to use the same base for the Land and Building Tax as well. Therefore, two different types of property tax, one relating to transactions and the other to occupancy, use the same tax base. It could be said that the tax base is an estimate value as there is massive political incentive to mitigate effects brought about by the property tax. Despite being based on the same assessment, the Land and Building Tax and the SDLT are calculated using different rates and by different authorities. While the Land Registry is responsible for the SDLT collection, local governments are responsible for the Land and Building Tax collection. Revenue raised from the Land and Building tax can be kept locally but revenue from the SDLT must be sent to the central government. It should also be noted that the appeal mechanism of the Land and Building Tax is separate from that of the SDLT.

The government has estimated that the total revenue from the Land and Building Tax in 2020-21 will be 40 billion baht (£1 billion), which is lower than previously expected at 70 billion baht (£1.7 billion) due to extensive tax relief schemes (Matichon, 2019). Another reason for low estimated tax revenue is that the building assessed price is lower than the market price due to the cost approach employed by the PVB (Bangkok Biz News, 2019). These two reasons are the main concern for the workings of the Land and Building Tax. This reduced estimate has caused concern that the tax will fall short of achieving its revenue generation and wealth distribution objectives.

A major criticism of the Land and Building Tax is that the exempted value of 50 million baht (about £1.11 million) for owner-occupied housings and agricultural lands is too high. It is estimated that there are only 15,700 out of 21.3 million householders who own land with values over 50 million baht, and only 5,000 householders own over 50 million baht worth of residential properties (Poapongsakorn, 2017). This means over 99 per cent of households are completely exempted from the Land and Building Tax. The exemption is part of the Land and Building Tax Act, which is difficult to amend. At least two problems arise as a result of the exemption. One is the disincentive for local governments to collect their own revenue. Even though the revenue from the Land and Building Tax is estimated to be more than that from the two previous property taxes combined, it is not certain which local governments have large enough tax base to finance their expenditures. The other problem concerns the narrow tax base itself as it can hardly promote local accountability in any way. From the benefit point of view, it is unlikely that voters will be aware of the costs of local public services when they are not liable for the tax. In general, a higher number of taxpayers leads to greater accountability in local government.

4.6 Property Assessment Practice in Thailand

In Thailand, property assessments for taxation are provided by the PVB, a government agency overseen by the Department of Treasury, Ministry of Finance. The assessed price prepared by the PVB that was originally used for the collection of SDLT is now used for the collection of Land and Building Tax as well. The PVB has adopted the mass valuation process, in which assessed prices are prepared in advance for every private property (both domestic and non-domestic) in the country. Assessed prices of properties on the same street (within certain blocks) are calculated from a single assessed value unique to that street unit. This is called street value, and is derived from transactions on the same or adjacent/similar streets. The PVB's guidelines consider land and building as distinct component (PVB, 2009). Therefore, there are two assessment lists, one for each component. The assessment process consists of the following steps (see also Appendix B):

(1) Data preparation
(2) Property survey
(3) Data analysis
(4) Assessed prices determination
(5) Assessment list and cadastral map preparation

There are two approaches used in the assessment process: market and cost. Market approach is used to assess land (without any developments thereon) while cost approach is used to assess improvement (building). These two approaches are used separately for two purposes. First, the market approach is specifically used for vacant or undeveloped land assessment. This means that only transaction data for land is included in the market assessment process without accounting for building thereon. Second, the cost approach is used to calculate building costs of sale data for developed lands to derive pure/vacant land value. This is because, as mentioned before, assessors must apply the market approach to compare only values of lands after deducting the building costs. The cost approach is also used to calculate total assessed value. This is because there are two components of the assessed prices: land value and building cost. In order to calculate the value of a detached house, for example, its assessed land value must be combined with assessed building costs in order to derive total assessed value. In order words, there are two separate lists of assessed prices: land and building.

4.6.1 Land assessment

Land assessment is carried out using the market approach, meaning land values are derived from and compared with land transaction prices, excluding building thereon. Property sale data used by the PVB, however, contains both undeveloped and developed lands. Vacant (undeveloped) land data is prioritised over that of developed land. But the amount of undeveloped land data is not sufficient for the valuation process, meaning developed land transactions have also been used in many instances. In the latter case, building costs are deducted from the total transaction prices, accounting for depreciation, to yield vacant land values (see Appendix A). Land assessed prices are based on transactions that occurred several years before the assessed prices came into effect. For example, the assessed prices for the assessment cycle 2016-19 (effective from 1st January 2016 to 31st December 2019) had been prepared using property sale data from 2012-2015. Therefore, assessed prices generally lag one to seven years behind market prices.

According to the PVB's land assessment manual, there are two main factors that play an important role in determining assessed value of land: parcel shape and depth (PVB, 2009). Typically, rectangular-shaped land parcels are considered to have the most potential, which means that they receive full assessed value. Irregular-shaped land parcels—i.e. flag- (hexagon) and triangular-shaped—are considered inferior in potential. Flag-shaped land with parcel width between two and eight metres on the road access side receives 75 per cent of normal assessed value, and that with a width less than two metres receives 65 per cent of normal assessed value. Flag-shaped land with a width over eight metres is considered to have full potential and receives normal assessed value. Triangular-shaped land receives 65 per cent of normal assessed value if road access is on any of its sides, and 35 per cent if access is on a corner.

Similarly, the depth of land parcel is taken into account in the process of assessed price determination. The depth is the distance from the middle point of the side adjacent to road access to the middle point of the opposite side. As shown in Table 4.5, the land assessment method of the PVB is based on seven different ranges of land parcel depth (PVB, 2009). The standard depth of land parcel that can receive full assessed price is 40 metres, but assessment regulation allows for a maximum extension of 25 per cent of the standard value, which is 50 metres. This means that a parcel 50 metres deep still falls in the first range and receives no deduction in assessed value. The

25 per cent rule is applied to all other depth ranges except the seventh. The greater the depth of a land parcel, the less value proportionate to normal assessed value it gets. The deduction rates of assessed value based on parcel depth are defined by multiplier. For example, a rectangular-shaped land parcel with a depth of 120 metres and located on a street with an assessed price (street value) of £600 per square metre would be assessed at £450 per square metre (75 per cent of the street value).

Table 4.5 Calculation of land parcel depth in PVB's assessment method

Range	Parcel Depth (Metre)	Multiplier (%)
1	No more than 50	100.00
2	51-90	87.50
3	91-130	75.00
4	131-170	62.50
5	171-210	53.75
6	211-250	46.88
7	Over 250	41.07

Source: Adapted from PVB (2009)

As well as the aforementioned factors, the PVB's land assessment process also takes into account land use and negative impact factors in terms of assessment reduction. Land use factors include, for example, the use of land as a private road (50 per cent reduction) and land filled with water deeper than 3 metres (75 per cent reduction). Negative impact factors include land with certain legal limitations that prevent the development of any type of structure (50 per cent reduction) and land affected by close proximity to high voltage electricity lines (70 per cent reduction for the area affected). Such areas are rare in practice, but appear in the standard because they are based on the decisions of property valuation committees regarding specific complaints.

4.6.2 Building assessment

Cost approach is used in building valuation. Prior to 2016, the PVB had provided 69 different types of buildings and three ranges of construction costs for each building type based on the quality of building materials. The selection of building type is completely subject to assessors' judgement. Since 2016, the PVB has reduced the number of building types to 31 and has cancelled three ranges of building quality and provided single building assessed value (per square metre) for each property class (see

Table 4.6). The building assessed values differ from province to province and the ones in Bangkok are the highest. After accounting for depreciation factors, building assessed values are then added to the vacant land assessed values to yield total assessed values of the whole properties. This is, in effect, the reverse of the process for assessing vacant land mentioned above.

Table 4.6 Examples of average building assessed values in Bangkok

Code	Building type	Assessed value per m^2 (Thai baht)
100	Detached house	7,500
200	Townhouse (terraced house)	7,450
300	Row house (single-storey)	7,200
400	Shophouse	7,600
501	Warehouse (area of 300 sqm. or less)	5,500
502	Warehouse (area over 300 sqm.)	3,400
505	School	7,500
506/1	Hotel (5 floors or less)	9,500
506/2	Hotel (over 5 floors)	9,800
508	Hospital	9,200
509/1	Office building (5 floors or less)	7,400
509/2	Office building (over 5 floors)	8,600
510	Restaurant	6,750
511/1	Department store	9,350
511/2	Commercial building	7,750
512	Petrol station	5,400
513	Factory	6,000
516	Home office	9,150
518	Garage	5,650
519	Car park building	5,650
520/1	Apartment (5 floors or less)	7,800
520/2	Apartment (over 5 floors)	9,000
522	Car showroom	5,500
524	Swimming pool	8,000

Source: Adapted from PVB (2016a)

It can also be seen in Table 4.6 that the rationale behind average building assessed values does not account for building quality factor. There are some inconsistencies in the classification of property. When it comes to residential properties, the classification is based on housing types—e.g. detached house, townhouse and shophouse; but in cases of commercial properties, the classification is based on uses/functions—e.g. hotel, office building and department store. This is not consistent with conventional property assessment standards. The IAAO's (2017) standard on mass appraisal of real property, for instance, suggests that the income approach is the most appropriate method in assessing commercial and industrial property, and sales comparison approach is an equally effective method when there are sufficient sales data available. The cost approach is in fact prone to errors and biases due to the variation in property

age—taking into account depreciation factors—and construction materials used. It is almost impossible to assess improvements accurately on the basis of mass surveys, in which assessors do not, in most cases, enter properties and inspect buildings. Without a thorough inspection, building values can hardly be accurately assessed.

The PVB's standard assessment approaches can be expressed as:

$$AV = LV + BC \tag{4.1}$$

where AV is assessed value; LV is land value; and BC is building cost.

$$LV = ULV \times LA \tag{4.2}$$

$$BC = MBC \times BA \times (1 - d) \tag{4.3}$$

where ULV is an average undeveloped land value; LA is land area (square metre); MBC is an average building cost (per square metre); BA is building area; and d is the depreciation factor.

The PVB provides vacant land values (LV in Equation 4.2) and average building costs (MBC in Equation 4.3). To get the whole property assessed value, local authorities have to combine their property data bases, which contain building areas and some other property characteristics, with the one provided by the PVB. In order to calculate final assessed value, three property characteristics are required: property type, building area and property age. Local authorities are required by law to carry out their own surveys to collect and update property data. Therefore, there are many factors that can cause variations in assessed values from one locality to another, which range from separate survey systems to the discretion of local government officers on property types.

4.7 Conclusion

In this chapter, I have described local administration and fiscal systems in Thailand and explained the geography of Bangkok. Three types of local governments are responsible for the collection of Land and Building Tax: Municipalities, SAOs and special administrative regions. Bangkok is classified as a special administrative region, which has more autonomy than other types of local governments. When the Land and Building Tax is implemented, it will have full control over tax collection and allocation. However, its power is limited to the administration function, meaning that the governor can decide on some appeal requests within certain limits of tax reduction, but cannot change tax rates or reassess properties.

The Land and Building Tax is certainly an improvement on the two previous recurrent taxes on occupancy in terms of tax structure and objectives. However, the tax relief scheme is problematic because of extensive exemptions on certain types of properties. Owner-occupied housing, for example, is exempted for up to 50 million baht (about £1.11 million) in assessed value. If we take the benefit tax view, housing is the type of property that should be taxed the most. Occupiers of residential properties are direct users of local services, meaning the more people who contribute to property tax, the more stakeholders in local expenditure there are. In this situation, local governments tend to have more accountability. Therefore, the government should reduce the range of tax exemptions and recalculate tax rates according to the new tax base.

The revenue from the Land and Building Tax in 2020 will be at best the same as those of the previous two occupancy taxes combined. The largest contributors to the tax revenue will be businesses and owners of vacant land. Taxing vacant land is economically viable and appropriate because it tends to cause less distortions. Taxing businesses will cause their costs to rise and will translate into lower competitiveness and incentives. This will directly translate into economic distortions, which may take the form of changing business behaviours such as disinvestments or layoffs. However, the logic of policymakers appears to be different from that suggested by tax theory. Reflected in the structure of the Land and Building Tax is the principle that commercial properties should be taxed higher than residential properties. The disadvantages of such a tax structure are that the relationship between tax contributors and benefit receivers can hardly be established and local accountability can hardly be improved.

Property tax assessment in Thailand is based on two main approaches: market and cost. Market approach is used for land value assessment and cost approach is used for building assessment. The two components of assessed prices are combined to form taxable values. The building costs are more inequitable than assessed land values for two reasons. First, the building costs in the list provided by the PVB are not actual costs. They are relatively low estimates of construction costs for certain property types. Second, the determination of building types is totally subject to local governments' judgement, which may vary from locality to locality. Although the PVB adopts a market approach, it is only used for the assessment of land, not the whole property. Such a system is prone to errors because there are too many steps in market price comparison and the process is not realistic. Accordingly, such a system is unfair because there is a tendency to minimise street value to accommodate the continuous spatial flow of assessed prices. Therefore, the owners of higher priced properties tend to gain from such tax assessment approaches more than the owners of lower priced properties. Such a situation tends to lead to a regressive tax structure, which may exacerbate the wealth accumulation problem.

In the next chapter we will reconsider the research questions and discuss the key methods used for data analysis. This study uses both spatial and non-spatial methods in the analysis of property data. The use of these methods in the research of property assessed prices is unprecedented in Thailand. It is expected that the use of spatial techniques will reveal some insights into the property assessment system that can help improve equity in the tax system.

Chapter 5 Methodology

This study employs three main analytical approaches: ratio analysis, spatial autocorrelation analysis and GWR. Ratio analysis is used to estimate the degree of progressiveness of the assessed price and to identify areas with property assessment problems. Local Moran's I is the spatial autocorrelation analysis technique used in this study. The purpose of this approach is to identify clusters and outliers of under- and over-assessed properties, which helps determine spatial distribution patterns of disparity of assessed and sale prices. The last approach, GWR, is a non-stationary technique that includes varying spatial relationships in the models. Variables included in GWR models have been derived from the relevant literature.

The ratio analysis and the spatial autocorrelation approaches are closely related in that both are used to identify similar areas/clusters with property assessment inequity. In the ratio analysis, properties that do not meet the standards are located using property identification number and cadastral map. Therefore, spatial distribution patterns of these properties can be compared with the results from spatial autocorrelation analysis. However, the spatial autocorrelation analysis can produce more meaningful results as it can detect clusters and outliers. GWR is then used to obtain insights into the relative impact that each explanatory variable has on both assessed and sale prices.

The first section presents detailed discussions of the research questions in relation to relevant research methods. Subsequently, section 5.2 discusses the data used in this study. It specifically explains the nature, sources, types and spatial distribution of the data. Section 5.3 gives an overview of all the three methods used in this study: ratio analysis approach, spatial autocorrelation analysis and GWR. Subsequently, a separate discussion of each method is presented from sections 5.4 to 5.6. The chapter concludes by acknowledging the limitations of these methods, and measures that can be used to alleviate them.

5.1 Research Questions Revisited

In the first chapter I addressed six research questions, most of which concern the equity of property tax systems. At the core of inequity problems in property tax systems are inaccurate assessments and poor tax administration. Inaccurate assessments are likely to generate objection from taxpayers and affect fiscal management of local government (Corusy, 1983). Assessment inaccuracy causes inequity in property tax systems through under- and over-assessment of tax base, which can be identified by ratio analysis. Accurate assessments can strengthen local fiscal stability and borrowing capacity, especially in systems where obsolete tax bases exist. Therefore, it seems that property assessments are the key to property tax equity as well as local stability. Progressiveness in assessed price can also be measured by the ratio analysis approach through the comparison of A/S ratios in all value ranges. However, this progressiveness is not the same as property tax progressiveness as the latter is largely determined by tax rate.

How can a property tax system be deemed (in)equitable? This is a very important question, which require us to reconsider some common terminology that has emerged in the literature. To achieve perfect assessment equity, assessment level (overall A/S ratio) must be consistent throughout a taxing district or a specified area. In a political jurisdiction with a uniform tax rate and equal A/S ratios for all properties, neither horizontal nor vertical inequity would exist, regardless of the value of the ratio (Paglin and Fogarty, 1972). In most cases where perfect assessment equity does not exist, however, a central tendency of A/S ratios is calculated. Median is frequently a top choice for measuring central tendency because it is less sensitive to extreme values, which are quite common in mass appraisal. In evaluating property assessments in practice, a permissible level of median A/S ratio in a jurisdiction or tax zone should at least fall within the IAAO's standard range of 0.9-1.1, and the overall spatial distribution of A/S ratios should be consistent across the area.

One pragmatic way of determining the level of assessment equity is to look at assessment uniformity within and between jurisdictions. Assessment uniformity is measured by calculating A/S ratios of all properties in a taxing district and gauging their divergence from an average assessment level. This would give us a 'big picture' of assessment uniformity, especially when the median assessment ratios are compared among jurisdictions. We can also perform a more in-depth analysis by mapping the geographical distribution of A/S ratios at individual property level. This would allow us

to discover patterns of non-uniformity in assessments. For example, exact location of inaccurately assessed properties can be identified if A/S ratios of properties along some streets are markedly different from the median ratios, particularly in cases where assessors adopt street-value assessment approach (see Section 4.6).

When it comes to the question of whether 'systemic' biases exist in the property tax system in Thailand and what the spatial distribution patterns of any assessment-sales discrepancy look like, we must assume that random inaccuracy can be identified and separated. In this case, the spatial autocorrelation analysis is useful in identifying clusters of problematic assessments. The hypothesis here is that clusters of A/S ratios, especially at borough and street levels, imply systemic assessment biases because assessors have been assigned tasks based on geographical areas, of which political jurisdictions and streets have been used as main criteria. We must take into account not only human errors but also consistent bias in assessment practices. In mass appraisal, it is unlikely that properties are assessed solely according to market information—e.g. recent sale prices, rental values, or improvement costs. Assessments in Thailand in particular have been largely based on past assessed prices, with current figures deviating little from accepted norms. Abrupt changes in assessments would raise questions and are likely to attract more appeals, which would increase workloads for assessors.

The question of whether there are any groups of cohorts—as defined by property value—that benefit from the discrepancy of assessed prices directly relates to the vertical inequity aspect of the assessment problem. Although information about property owners in the data sets provided by the Land Registry have been concealed, it is still possible to use property sale price to represent property wealth. Higher property sale price reflects higher property wealth, and vice versa. Vertical inequity exists when properties with different values have different A/S ratios, which can be determined either by straightforward comparisons of A/S ratios of properties controlling for types and values (Oldman and Aaron, 1965) or by regression analysis of A/S ratios and sales price (Bell, 1984; Cheng, 1970; Clapp, 1990; IAAO, 1978; Kochin and Parks, 1982; Paglin and Fogarty, 1972). Both approaches are used in this study.

This leads to the next research question about important determinants of housing assessed price. It is important to examine horizontal inequity in the property tax system because certain irregularities tend to exist when similar-valued housings have not been

assessed in the same fashion. When properties with the same market values receive different assessments, they may be treated differently by the property tax system, especially when they fall on different tax rate thresholds as a result of progressive tax rates. If so, the magnitude of assessment inequity is amplified by the structure of the tax system. Another concern regarding horizontal inequity is that there might be some drastic changes that have positively—or negatively—influenced property prices in particular housing submarkets[6]. The provision of extensive-scale data by the PVB and the Land Registry has made it possible to perform GWR analysis to determine influential variables of assessed housing values. The results will be compared with the assessment standards set by the PVB to determine whether irregularities in assessed prices in certain areas have been caused by assessors or the market.

My final research question is 'what are the appropriate property assessment approaches that can produce more equitable tax liability, and to what extent will this help improve the property tax system in terms of a more suitable tax base, rate and structure?'. I have generated two additional hypotheses regarding this matter. First, as in other types of tax, wider property tax base—minimal tax exemptions/reductions and comprehensive assessments—would serve local governments more efficiently in terms of revenue generation and co-operation from taxpayers. Given the same amount of local revenue requirement, a wider tax base means there is less tax liability for each individual compared with narrower tax base, which tends to cause less resistance from taxpayers. More taxpayers also mean that more people tend to be aware of the costs of local public services, and as a result they have incentive to monitor local government spending.

My second hypothesis is that, assuming a stationary tax rate, higher A/S ratios with less variability would cause the property tax system to become more equitable and easier to administer. This can be achieved through more frequent reassessments. In ad-valorem taxation, assessments are the key component that must always be accurately maintained in order to allow for other components of tax systems to function properly—i.e. tax rate and tax administration. Inaccurate assessments tend to reduce the effectiveness of ad-valorem tax policies for this reason. If the types of assessment

[6] A housing submarket is defined as "a set of dwellings that are reasonably close substitutes for one another, but relatively poor substitutes for dwellings in other submarkets" (Bourassa *et al.*, 1999, p. 161).

inaccuracy can be identified, it is likely that we can make more informed decisions on the improvement of assessment approaches.

5.2 Data

The data in this study has been collected from various primary sources, all of which are public authorities in Thailand. There are two main data providers: the Land Registry and the PVB. The Land Registry provided cadastral maps, property records and sale data. The PVB provided assessed values for all private properties in Bangkok including property characteristics data collected during surveys. I have also obtained assessment manuals and have carried out informal interviews with assessors from the PVB. Seven members of the PVB were interviewed: four operational staff and three executive staff. The operational staff interviewed included assessors and researchers. It is the role of assessors to carry out property surveys and determine assessed prices according to the standard written and revised by researchers. The three executive-level staff interviewed were the director of the PVB, who is responsible for assessment policy, and the managers of the property assessment divisions for East and West Bangkok respectively.

The Land Registry normally keeps records of registry data in paper form. Land parcel shapefiles have been digitised from the paper maps and tenure information obtained from registry documents. The data set comprises 2.14 million records of all properties in Bangkok. Land registry data in Thailand are not open to public inspection. Only property owners or persons who have owners' consent can have access to the data. The data used in this study excludes sensitive information such as names and identification numbers of property owners. Properties are identified by either the registry document number or a unique code consisting of three components of the Universal Transverse Mercator (UTM) map: sheet, page and parcel numbers. This study uses the UTM map's sheet-page-number code to make the analysis consistent with the identification in the assessed price data set obtained from the PVB.

The PVB typically uses both paper and digital versions of cadastral maps. Digital maps are mainly used in the assessment process but paper maps are also needed for reference as they are more up-to-date. This is because changes to property registry are first made on paper cadastral maps at local land registry offices. The land registry shares updated information on cadastral maps and registry documents with the PVB quarterly. Therefore, data verification can be done by comparing identical data sets obtained from both authorities. Parcels that can be merged by both identification number and land area are deemed accurate as they have already been validated by assessors during the assessment process. However, the data sets obtained from the PVB

seem to have more details about property characteristics (e.g. floor area, road width and neighbourhood quality), which have been collected during surveys.

Apart from the assessment data, the PVB also provided street value data, in the form of a summary of all units of assessed value at street level. A unique code is assigned to each ‘street unit’, which represents only one assessed street value. The assessed ‘street value’ is used to calculate final land values of all properties in a particular street. There are specific criteria by which final land values can be assessed, based on depth and shape of land parcel. In general, a land parcel with a square shape and depth of 40 metres or less receives full value of the street on which it is located. Properties with irregular shapes and greater depth normally receive reduced street values. The street value data contains four types of land use: residential, agricultural, commercial and industrial. As shown in Table 5.1, residential street units—excluding condominium—far outnumber those of other types of property largely due to assessment practices. When assigning street units, assessors consider the majority of property types in each area. Therefore, other than high streets, agricultural zones and industrial estates, most areas in Bangkok have been classified as residential uses.

Table 5.1 Number of units of street value

Type of land use	Number of street units	Percentage change from previous assessment cycle
Residential	55,111	1.71%
Agricultural	6,012	13.85%
Commercial	5,373	6.22%
Industrial	116	9.68%

Source: PVB (2019)

Table 5.2 Example of the PVB's street value list

UTM number	UTM page	UTM ratio	Unit	Unit name	Street ID	SMG	Standard parcel depth	Type of land use	Road surface	Road width	Total width including pavement	Street value	Comparison				Previous assessments		Change (%)
													Group	Unit	Price per sq.m.	Result	Price per sq.m.	Standard parcel depth	
6226	03	1:1000	1	Piboonsongkram road	ST210	1B21	40	Commercial	Concrete	18	32	37,500	47	-	150,000	Market price	32,500	40	0.15
6226	03	1:1000	2	Alley connected to Piboonsongkram road	S0501	1B43	40	Commercial	Gravel	3	5	11,250	-	6226-03-1000-2	45,000	Maintain price	11,250	40	0.00
6226	03	1:1000	3	Walk way connected to Piboonsongkram road	S0502	1R51	-	Residential	Concrete	1	1	7,500	-	6226-03-1000-3	30,000	Maintain price	7,500	-	0.00
6226	03	1:1000	4	Lands without legal access	IS01	1I00	-	Residential	-	-	-	1,875	-	6226-03-1000-4	7,500	Maintain price	1,875	-	0.00
6226	04	1:1000	1	Piboonsongkram road	ST210	1B21	40	Commercial	Concrete	18	32	37,500	47	-	150,000	Market price	32,500	40	0.15
6226	04	1:1000	2	Alley connected to Piboonsongkram road (terraced houses)	S0504	1R41	40	Residential	Concrete	6	8	15,250	-	6226-04-1000-2	61,000	Maintain price	15,250	40	0.00
6226	04	1:1000	3	Alley leading to office buildings	S0503	1B41	40	Commercial	Concrete	5	6	15,000	-	6226-04-1000-3	60,000	Maintain price	15,000	40	0.00
6226	04	1:1000	4	Walk way leading to CPAC Ltd.	S0506	1R51	-	Residential	Concrete	1	1	7,500	-	6226-04-1000-4	30,000	Maintain price	7,500	-	0.00
6226	04	1:1000	5	Walk way adjacent to Government Housing Bank	S0505	1R51	-	Residential	Concrete	1	1	7,500	-	6226-04-1000-5	30,000	Maintain price	7,500	-	0.00
6226	04	1:1000	6	Lands without legal access	IS01	1I00	-	Residential	-	-	-	1,875	-	6226-04-1000-6	7,500	Maintain price	1,875	-	0.00
6228	12	1:1000	1	Piboonsongkram housing project alley	S0194	1R41	40	Residential	Concrete	6	8	13,750	118	-	55,000	Market price	13,625	40	0.01
6228	12	1:1000	2	Wongsawang 11 alley (2)	S0191	1R41	40	Residential	Concrete	4	4	11,250	90	-	45,000	Market price	11,250	40	0.00
6228	12	1:1000	3	Alley connected to Wongsawang 11	S0183	1R41	40	Residential	Concrete	4	4	5,000	-	6228-12-1000-3	20,000	Maintain price	5,000	40	0.00
6228	12	1:1000	4	Alley connected to Wongsawang 11 (2)	S0184	1R43	40	Residential	Gravel	3	3	4,500	-	6228-12-1000-4	18,000	Maintain price	4,500	40	0.00
6228	12	1:1000	5	Walk way connected to Piboonsongkram project	S0195	1R51	-	Residential	Concrete	1	1	3,125	-	6228-12-1000-5	12,500	Maintain price	3,125	-	0.00
6228	12	1:1000	6	Walk way connected to Serene Park project	S0211	1R54	-	Residential	Earth	1	1	2,500	-	6228-12-1000-6	10,000	Maintain price	2,500	-	0.00
6228	12	1:1000	7	Serene park project 2	S0186	1H41	-	Residential	Concrete	9	10	17,000	-	6228-12-1000-7	68,000	Maintain price	17,000	-	0.00
6228	12	1:1000	8	Lands without legal access	IS01	1I00	-	Residential	-	-	-	1,875	-	6228-12-1000-8	7,500	Maintain price	1,875	-	0.00

Source: Adapted from PVB (2019)

The street value data set is useful because it represents the rationale behind the assessments (see Table 5.2). Each street unit represents certain unique characteristics that have been valued by assessors. More importantly, the street ID field in the street value data can be linked to the assessment data set, which has made the spatial analysis of assessment practices at property level possible. Another useful piece of information in the street value data set is the SMG field, which stands for sub-market group. SMG has served as a key method for reassessment for almost a decade—over the last two assessment cycles. It is a classification technique that reflects, for example, land use types, neighbourhood characteristics and basic infrastructure qualities. Therefore, the SMG code can be compared with changes in assessed and sale prices to investigate the variations of A/S ratios.

Sample data in this study includes residential property transactions reported between 2008 and 2017. There are 69,724 observed properties that have been randomly, but proportionately, selected from the main types of housing throughout Bangkok. As shown in Figure 5.1, the highest concentration of observed housings can be found in the eastern and western suburbs while the data is less concentrated in some parts of the city centre and the eastern and south-eastern fringes of the city. This is in part a result of Bangkok's planning policies since the late 1990s, which have imposed restrictions on new developments of low-rise housing in the city centre and on the development of housing projects in eastern boroughs such as Nong Chok and Lad Krabang.

Figure 5.2 shows a choropleth map of Bangkok's city plan as defined by land use regulations (City Planning Division, 2013). There are six broad types of land use as indicated by colours: yellow, orange and brown for residential; red for commercial; purple for industrial; green (striped and solid) for agricultural; beige for cultural preservation zone; and blue for government use. Most development restrictions have been imposed on agricultural use, while the fewest restrictions apply for commercial use. With residential use, for instance, colour shades—yellow, orange and brown—indicate the degree of development restrictions. Darker colours mean higher density residential developments are permitted. In this regard, the legislation is similar to the green belt policy in the UK, which aims to protect land from development and control urban expansion. The development restrictions in the city plan are consistent with the

number of housing observations shown in Figure 5.1. The effects of the city plan are also evident in urban development density shown in Figure 6.15.

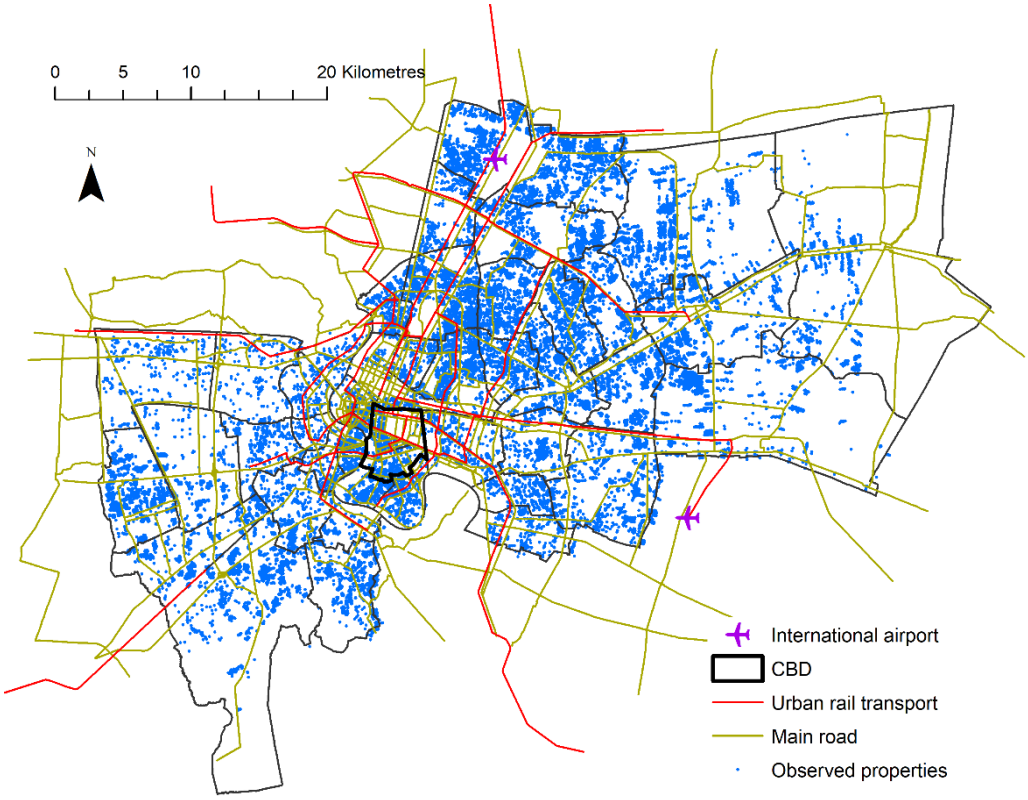

Figure 5.1 Location of observed data

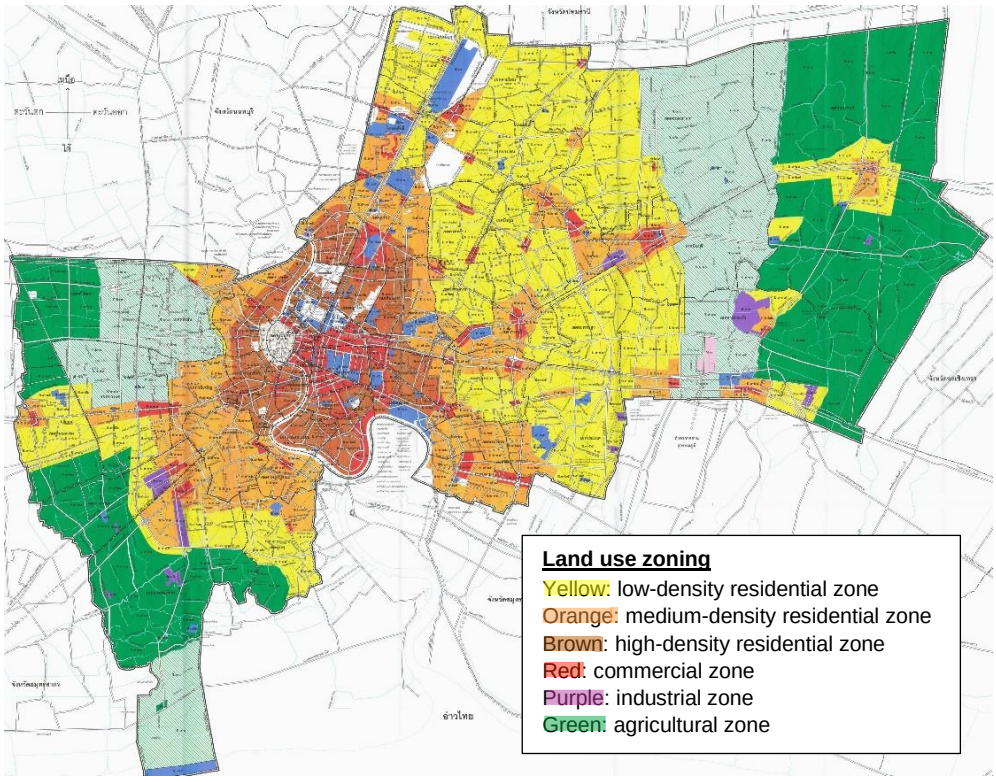

Figure 5.2 City of Bangkok plan (Source: City Planning Division, 2013)

Figure 5.3 shows the main types of housing under observation in this study. Terraced houses (also known as 'townhouses' in Thailand), typically featuring two to three storeys, are popular among low- and medium-income households—except those located on prime locations. Most terraced houses in Thailand have small car parks inside their gated areas. Shophouses are a vernacular building type commonly seen in urban areas of Bangkok. They are mixed-use buildings, typically two to four storeys high, characterised by shops on the ground floor opening to the pavement and residential units, offices or storage on higher floors. Semi-detached and detached houses are commonly found in suburban areas where less development restrictions are applied. During the past twenty years, Bangkok has seen more developments of gated communities containing terraced, semi-detached and detached houses, of which owners need to pay fees for services provided such as private security and maintenance of common areas.

(a) Terraced houses

(b) Shophouses

(c) Semi-detached houses

(d) Detached houses

Figure 5.3 Common types of housing in Bangkok (Source: Author's collection)

The spatial distribution of all types of housing mentioned above—as compared with the density of all property types—is shown in Figure 5.4 (a-d). It is immediately evident that the most prominent type of housing in Bangkok is detached house. Terraced houses are similarly but less densely distributed. As seen in Figure 5.4 (b), shophouses are largely located in the inner-city areas and some north and north-western

boroughs. Semi-detached houses are widely dispersed but few in number. They are not popular because of the shared wall between two properties. In some cases, semi-detached houses were only built because of certain restrictions of the city plan or limited project space, which made it impossible for the development of detached houses.

Figure 5.4 Distribution of residential properties in Bangkok by type

The following sections discuss in detail all analytical approaches in this study. There are three measures that form parts of ratio analysis: level of Assessment (LOA), coefficient of dispersion (COD) and price-related differential (PRD). Ratio analysis results are mapped to present geographical distribution patterns of assessment inequity. The results of ratio analysis are used to initially evaluate the quality of assessed price, and to identify assessment bias. Univariate local Moran's analysis is then performed on A/S ratios to examine the presence of spatial autocorrelation. Bivariate local Moran's analysis is performed on assessed price in relation to sale price, and vice versa. Finally, GWR models are constructed using variables related to housing and neighbourhood

characteristics. Assessed and sale prices are assigned as dependent variables. It is expected that neighbourhood characteristics will have more impact on assessed prices than sale prices, while housing characteristics will have limited influence on both dependent variables.

5.3 Overview of the Methods

Data analysis in this study is based on three principle methods. First, the analysis begins with a non-spatial method of ratio analysis, which consists of three traditional measures: LOA, COD and PRD. These measures are widely used by assessment standard organisations around the world, e.g. IAAO and RICS. The measures are specifically designed to evaluate property assessments in mass appraisal system, in which properties are often assessed in large number and within a limited time frame. The property assessment system in Thailand is a good example of a mass appraisal system, in which properties are assessed every four years. LOA is used to measure average level of A/S ratio distribution. COD is used to measure horizontal equity, while PRD is used as an indicator of vertical equity.

The second method is spatial autocorrelation analysis (global and local Moran's I), which is used to determine the spatial patterns of assessed prices. The method allows us to understand the presence of spatial bias in the data. In this regard, the use of standard non-spatial statistics may give biased results. Therefore, both global and local spatial statistics are used in this study. A/S ratio is the only variable used in the analysis. In particular, local Moran's I is used to examine areas with positive and negative spatial autocorrelation. Positive spatial autocorrelation includes clusters of high-high and low-low values, whereas negative spatial autocorrelation includes outliers of high-low and low-high values.

Finally, the analysis results of the two previous methods then lead to the introduction of GWR, which accounts for the spatial variation in the distribution of attributes. With GWR models, I aim to explain the variation in assessed prices throughout the study area by including both intrinsic and extrinsic variables. Intrinsic variables are real property characteristics that directly affect property value. Examples include property age, number of bedrooms and level of development of the surrounding area. Extrinsic variables are external factors that have an influence on property value—e.g. housing supply, population density and mortgage rate. In practice, factors affecting assessed prices may be different from those affecting sale prices, depending on the nature of each assessment system.

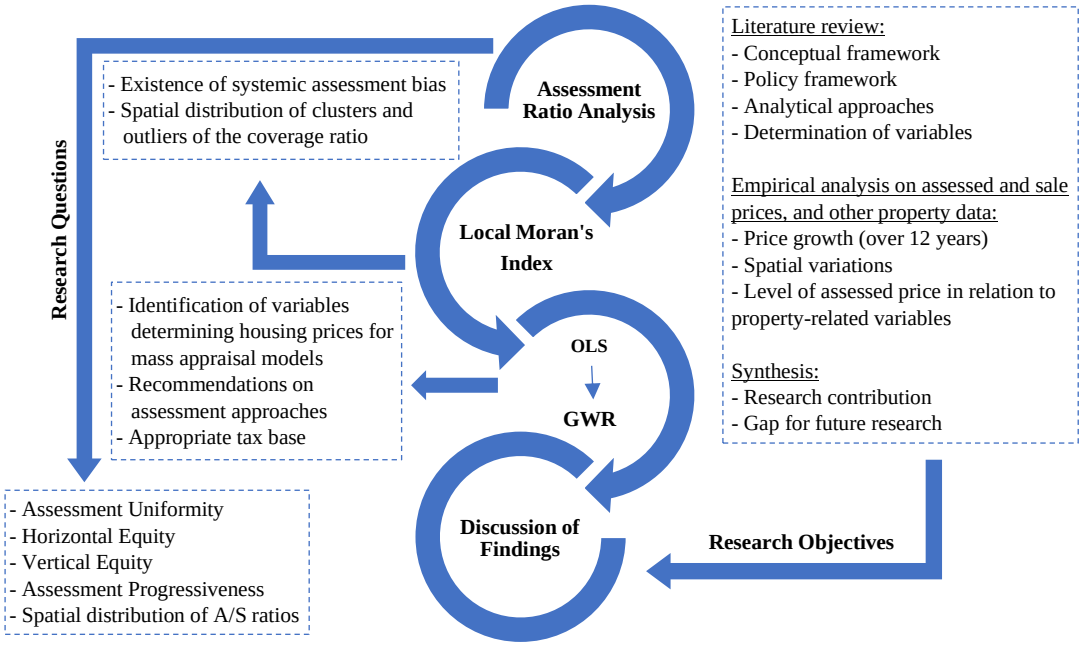

Figure 5.5 Methodological diagram

Figure 5.5 shows a process flow diagram of methodological approaches employed in this study. It can be seen that the three approaches are used in sequential order. The analysis begins with the ratio analysis (of A/S ratio) to measure assessment uniformity and equity. After obtaining the results of ratio analysis, global and local Moran's analysis are used to analyse property price at a more complex level. What the method tries to achieve is to identify the existence of systemic biases within the assessment system, their causes and ways to improve them. The interpretation is based on basic cluster and outlier analysis in relation to road networks, urban transport networks, important landmarks and other public amenities. The final approach employed is GWR, which is also incorporated with OLS for the purpose of model selection. It is expected that the results of GWR, which suggest the influence of each variable, will help determine appropriate assessment approaches. This will directly affect the quality of assessed prices. The results can also help determine an appropriate level of tax rate, but this is beyond the scope of the current study as it would require a more comprehensive analysis including all types of land use.

5.4 Assessment Ratio Analysis

The most common method for evaluating mass property assessments is to compare assessed prices with subsequent sale prices. This is normally done by calculating A/S ratios. Ideally, A/S ratios should be equal to one, which means that assessed prices can perfectly reflect market prices. Any ratios lower than one indicate that properties are generally under-assessed, and any ratios greater than one indicate that properties are generally over-assessed. However, apart from being directly interpreted, A/S ratios are also used as a basis for other analytical approaches. As shown in Table 5.3, there are three conventional measures associated with A/S ratios. LOA is a simple measure that employs median to find a central tendency of A/S ratios in a taxing jurisdiction. COD is used as a preliminary indicator for horizontal inequity, which is expressed as the percentage deviation of all properties in a jurisdiction from median A/S ratio. PRD is a measure of vertical inequity, which should ideally be equal to one. PRD values that deviate from one indicate either assessment progressivity or regressivity, neither of which is desirable by most assessment standards[7].

Table 5.3 Criteria for evaluating assessment performance

Evaluation Criteria	**Descriptive Analyses**
Level of Assessment (LOA)	Median A/S ratio
Horizontal Equity	Coefficient of Dispersion (COD)
Vertical Equity	Price Related Differential (PRD)

Source: Author's summary

In ratio studies, quality of property assessments is measured in terms of accuracy. Assessment accuracy is defined as 'the degree to which properties are assessed at market value' (IAAO, 2013b, p. 7), which can be measured by A/S ratios. Market value as an economic concept is assumed to be reflected in sale price, which is also referred to as market prices in ratio studies. As mentioned in Chapter 3, there are two aspects of assessment accuracy: level and uniformity. Assessment level refers to the overall A/S ratio of a jurisdiction, often reported in central tendency terms (median or weighted mean). The evaluation of assessment level is often made with regard to groups of properties, rather than on an individual basis, to reflect the nature of the mass appraisal

[7] It should be noted that assessment progressivity and regressivity in this context differ from the concept of progressive and regressive tax rates in fiscal economics. Progressivity and regressivity described here directly refer to property assessments.

system. Assessment uniformity refers to the degree to which properties are assessed at a similar proportion to the market value. The results are normally compared among different boroughs to establish fairer levels across the whole city.

5.4.1 Level of Assessment (LOA)

LOA estimation is based on a central tendency or the median A/S ratio. It is used to measure assessment uniformity between jurisdictions. LOA is a product of sorting all A/S ratios in a jurisdiction (or stratum) from the lowest to highest value, and reporting the middle data point. The mean (average) and weighted mean (value-weighted average) can also be used but the median is preferable because it gives equal weight to each ratio and is less sensitive to extreme values. The result is a point estimate which acts as the only indicator of the whole population. LOA is normally accompanied by confidence intervals (typically 95%) in order to indicate the reliability of the sample as a predictor of total levels of assessment for the population. An internationally accepted standard set by the IAAO allows 10 per cent assessment error on either side of the market value, which means that median A/S ratio must lie between 0.90 and 1.10 (IAAO, 2013b).

In this study, LOA results are presented by comparing the median A/S ratios for all boroughs in Bangkok. The comparison gives the approximate tendency of the distribution of assessed and sale price disparity. Further analysis is carried out by calculating the proportion of A/S ratios in each borough that meets the IAAO standard. The proportion not only indicates the percentage of acceptable ratios but also shows a tendency of deviation from the standard in some areas. In this study, A/S ratios in all boroughs are generally below the standard range, which indicates that most properties are under-assessed. The assessment level is also be analysed in terms of geographical distribution by plotting all the under- and over-assessed properties on maps.

5.4.2 Coefficient of Dispersion (COD)

COD is a measure of horizontal equity, which can be achieved when properties with similar values are taxed at similar rates. COD is an absolute deviation from the median in percentage terms. It can be interpreted as an average percentage difference of all A/S ratios of the observations from the median A/S ratio. A COD of zero indicates perfect horizontal equity. The IAAO standard allows for 10 per cent range around the median

A/S ratio. However, in areas where housing types are more diverse—for example, in terms of age and design, the standard of 15 percentage range can be applied (IAAO, 2013b). The COD can be mathematically expressed as:

$$COD = \frac{100}{Median_{\frac{A}{S}}} \times \left[\frac{\sum_{i=1}^{n} \left(A_i - Median_{\frac{A}{S}} \right)}{n} \right] \quad (5.1)$$

where A_i is the assessed value of the i^{th} property; S_i is sale price of the i^{th} property; and $Median_{A/S}$ is the median of jurisdiction/strata sample A_i/S_i.

COD level largely depends on overall size of a jurisdiction, profile of property characteristics and market activities (Ibid.). Size of jurisdiction may affect the profile of property characteristics as housing characteristics are likely to be more diverse in larger jurisdictions. A high level of market activities means there are more property transactions and may result in higher property prices. All of these factors tend to affect level of assessment and change in market prices, which of course directly affects COD results.

The purpose of COD in this study is to explore overall geographical distribution patterns in the disparity between assessed and sale prices rather than to determine whether or not the levels of assessed prices meet the acceptable standard. The results are presented by ranking COD levels of all boroughs in Bangkok. COD results are mapped to make it easier to relate to geographical areas.

5.4.3 Price-Related Differential (PRD)

PRD is an index that measures vertical equity, which can be achieved when taxpayers contribute proportionately to their property wealth. In other words, the higher the property values are, the higher tax assessment should be levied. PRD is calculated by dividing mean A/S ratio with weighted mean A/S ratio. An index level of one would indicate perfect vertical equity. A PRD level above one indicates assessment regressivity (or it could also imply that lower priced homes tend to be over-assessed), and a level below one indicates assessment progressivity (or it could also imply that higher priced homes tend to be over-assessed). The IAAO standard suggests that the index should lie within a 0.98-1.03 range (IAAO, 2013b). The PRD can be mathematically expressed as:

$$PRD = \frac{\sum_{i=1}^{n} \frac{A_i}{S_i} \Big/ n}{\sum_{i=1}^{n} A_i \Big/ \sum_{i=1}^{n} S_i} \quad (5.2)$$

where A_i is the assessed value of the i^{th} property; and S_i is the sale price of the i^{th} property.

However, PRD may not be sufficiently reliable when the sample size is small or the data contains extreme sale prices. In this case, a useful diagnostic tool is a scatter plot of A/S ratios versus assessed or sale prices (Ibid.). In this study, the purpose of using PRD is mainly to identify areas with relatively high numbers of over- and under-assessed properties. It is a quantitative measure used to compare boroughs across Bangkok. Similar to LOA and COD, PRD acts as a preliminary indicator for assessment biases. PRD levels for all boroughs are compared and presented by table and choropleth map.

5.5 Spatial Autocorrelation Analysis

The potential for estimating geographical distribution of assessment inequity is explored using a spatial autocorrelation analysis. This study uses Moran's I, which is a classic statistical tool that allows for simultaneous observation of both feature locations and non-spatial values (Moran, 1950). In simple terms, it is an index of similarity and dissimilarity. Using A/S ratios of all observations, the significance of biased assessment clustering is based on the z-score, and assessment inaccuracy can be detected by the cluster and outlier analysis of A/S ratios. General tests are carried out by the global Moran's statistic to identify the existence of overall clustering. If the global test finds no positive autocorrelation, the local test can be used to identify isolated hotspots of increased value of the attribute. When the global test[8] indicates a significant deviation from randomness, the local test can help determine either the study area is homogenous or there are local outliers that contribute to a significant global statistic of positive spatial autocorrelation (Rogerson, 2015).

In this study, the spatial autocorrelation analysis is used because there may be geographical bias in the property price data—i.e. certain areas may share higher or lower A/S ratios compared to others, or large clusters of abnormal levels of A/S ratios may exist in certain parts of the case study area. Local Moran's I can help identify such areas by comparing the values in each locality with those of its neighbouring areas. Once locations of positive/negative spatial autocorrelation are identified, the results can be compared with the spatial distribution of the levels of assessment throughout the study area. These groups of clusters and outliers can be interpreted in a number of ways depending on the relative levels of assessed and sale prices in each particular area.

The detection of geographic clusters can be classified into three primary areas (Besag and Newell, 1991). First, 'general tests' are used to detect overall patterns for a map consisting of point locations. They provide a test for the null hypothesis that there is no underlying pattern (or random pattern). Second are "focused tests", often used when there is a priori idea of cluster location. They may be used, for example, to find a link between specific subway stations and clusters of relatively high assessed housing values. Finally, if there is no preconceived idea of where clusters locate, 'tests for the detection of clustering' are used to uncover the size and location of any possible

[8] Other global tools are nearest neighbour analysis (Clark and Evans, 1954) and quadrat analysis.

clusters. The global Moran's statistic can be expressed as follows:

$$I = \left[\frac{\mathrm{n}}{\sum_{i=1}^{n}(y_i - \bar{y})^2}\right] \times \left[\frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}\,(y_i - \bar{y})(y_j - \bar{y})}{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}}\right] \tag{5.3}$$

where n is the number of regions; and w_{ij} is a weight matrix that represents spatial proximity between region *i* and *j* (Moran, 1950).

The global Moran's coefficient distinguishes compactness from sprawl. It is a single average value, ranging from -1 to +1, which applies to the entire data set. High values (close to +1) indicates a strong spatial pattern, while low values (close to -1) indicates a strong decentralised, sprawling form. In the case of positive spatial autocorrelation, high values tend to locate near one another, and vice versa. Finally, values near zero indicate a lack of spatial pattern. Values of -1 or +1 are unlikely to occur because of the low probability that the data will be perfectly spatially autocorrelated. Therefore, in practice, a value of +0.3 or more, or of -0.3 or less, is an indication of strong spatial autocorrelation (O'Sullivan and Unwin, 2010).

However, the global Moran's statistic does not suggest the location of clusters as it is intended to provide a test of the null hypothesis that the A/S ratios are randomly distributed among the data points in the study area. If we can reject the null hypothesis, local Moran's statistic can be used to identify specific locations of outliers and clusters. Instead of summarising values of A/S ratio over an entire data area, local Moran's statistic calculates only the A/S ratios in the same locality as each data point. Two types of local Moran's statistics emerge in the literature: univariate and bivariate. The univariate local Moran's statistic can be expressed as:

$$I_i = z_i \sum_j w_{ij} z_j \tag{5.4}$$

where z_i is the standardised value of the A/S ratio of area *i*; z_j is the standardised value of the A/S ratio of area *j*; and w_{ij} is the spatial weight matrix that reflects the degree of association between area *i* and *j* (Anselin, 1995).

In the univariate local Moran's analysis, an A/S ratio is calculated for each property (i) to be compared with neighbouring properties (j) through weight matrix (w) within a specified distance threshold (d). A/S ratio is used to calculate the local Moran's index because it is a widely accepted measure for property assessment and sale price discrepancy, which is especially useful in determining spatial inequity when comparing different geographical areas. The bivariate local Moran's statistic can be expressed as:

$$I_{xy}^{i} = z_{x}^{i} \sum_{j} w_{ij} z_{y}^{j} \tag{5.5}$$

where z_x^i is the standardised value of the variable *x* of area *i*; z_y^j is the standardised value of the variable *y* of area *j*; and w_{ij} is the spatial weight matrix (Anselin *et al.*, 2002).

The bivariate local Moran's statistical analysis adopts similar principles to the univariate analysis, but has been developed to examine spatial correlation between two variables. The bivariate local Moran's statistic tests for the correlation between one variable (*x*) and the spatial lag of another variable (*y*) (Anselin *et al.*, 2002). However, the bivariate analysis does not take into account the inherent correlation between the two variables at the same locations (between x_i and y_i). Instead, what the test emphasises is the spatial correlation between x_i and $\sum_j w_{ij} y_j$.

The bivariate local Moran's statistic can potentially be adopted to test for spatial relationship between A/S ratios and housing density. If the value of A/S ratios is correlated with the spatial lag that pertains to the housing density variable, we can examine the patterns of level of assessment distribution in relation to the level of housing development. In this thesis, however, only the univariate local Moran's statistic is applicable because the A/S ratio and housing density variables exhibit strong and consistent spatial correlation. Therefore, only the A/S ratio variable is used as it serves as a proxy for the housing density variable. The data are tested for statistical significance and represented by choropleth mapping at four different scales: borough, sub-district, 1-kilometre grid and 500-metre grid. The representation in different areal units has been proven to overcome the scale sensitivity issue (see Shiode et al., 2014).

The results that are particularly relevant in this study are those indicating negative spatial autocorrelation or outliers of high-low and low-high values. High-low (or low-high) outliers indicate that areas of potentially over-assessed (or under-assessed) properties are surrounded by neighbourhoods of under-assessed (or over-assessed) properties. These two results are likely to indicate systemic errors in assessments. However, a positive spatial autocorrelation is also important for the identification of particularly large areas of assessment uniformity, which may be caused by a sudden increase in assessed prices compared with the previous assessment cycle. Parcel-level observation is then required to find geographical distribution patterns of test results, potentially by analysing them along with road networks. This analytical method is consistent with the assessment practices adopted by the PVB that tend to group property transactions on certain streets or within certain neighbourhoods together in the assessment process.

5.6 Geographically Weighted Regression (GWR)

GWR is a spatial variant of regression modelling. It is a non-stationary technique that takes into account geographical distortions of data. In other words, GWR is a local statistic used to model spatially varying relationships between variables. Based on the local Moran's analysis that identifies spatial heterogeneity in the data, spatial non-stationarity can be examined by GWR modelling. A local model must be estimated at each data point in the study area so that the observed data are spatially weighted according to their proximity to the location. Like other local statistical approaches, nearby data points are weighted more heavily than those from more distant locations (O'Sullivan & Unwin, 2010). A general form of the GWR model can be expressed as (Fotheringham *et al.*, 1998, 2002):

$$y_i = \beta_{i0} + \sum_{j=1}^{m} \beta_{ij} x_{ij} + \varepsilon_i \tag{5.6}$$

where y_i is the dependent variable at location *i*; x_{ij} is the j^{th} independent variable at location *i*; β_{i0} is the intercept parameter at location *i*; β_{ij} is the local regression coefficient for the j^{th} independent variable at location *i*; *m* is the number of independent variables; and ε_i is the random error at location *i*.

GWR allows β coefficients to vary spatially, which can offset any imbalance of spatial heterogeneity. The model estimates a local-specific coefficient for every independent variable. Each set of local regression coefficients is estimated by weighted least square, in which a weighting scheme W_i is applied to each squared difference (Brunsdon *et al.*, 1996). The matrix for the estimation of local coefficients can be generally expressed as:

$$\hat{\beta}_i = (x^t w_i x)^{-1} x^t w_i y \tag{5.7}$$

where $\hat{\beta}_i = (\beta_{io}, \ldots, \beta_{im})^t$ is the vector of m+1 local regression coefficients; x is the matrix of the independent variables; y is the dependent variable vector; and w_i is the diagonal matrix denoting the geographical weighting of each observed data for regression point *i*.

When determining the regression weight for each local model, a kernel function is applied (Fotheringham *et al.*, 2002). In this study, the weighting scheme is calculated with a Gaussian kernel function, which can be defined as:

$$w_{ij} = exp\left[-\frac{1}{2}\left(\frac{d_{ij}}{b}\right)^2\right] \tag{5.8}$$

where d_{ij} is the distance between observation point j and regression point i; and b is the kernel bandwidth, which can be specified either by a fixed distance (i.e. fixed bandwidth) or by a fixed number of neighbouring observations (i.e. adaptive bandwidth). If there is a significant variation in the data set, an adaptive variable bandwidth is usually applied. During model calibration, an optimum bandwidth is specified by the Akaike Information Criterion (AIC), which accounts for model parsimony (Akaike, 1973). Unlike the cross-validation (CV) score, the AIC also accounts for model complexity in the goodness-of-fit diagnosis.

Table 5.4 Descriptions of variables and data sources

Variable	Source	Measure
Assessed price	PVB	Baht
Sale price	LR	Baht
Housing age	LR	No. of years
Living area (building area)	LR	m^2
Land area	LR	m^2
Population density	Calculate using GIS	No. of resident/ km^2
Property density	Calculate using GIS	No. of property/km^2
Housing sale density	Calculate using GIS	No. of properties/km^2
Distance to main roads	Calculate using GIS	m
Distance to urban rail transport stations	Calculate using GIS	m
Employment accessibility (distance to CBD)	Calculate using GIS	km (to CBD)

Note: PVB = Property Valuation Bureau; LR = Land Registry; km = kilometre and m = metre

Variables included in GWR models are shown in Table 5.4. There are two groups of independent variables: one is related to land use features and the other is related to neighbourhood characteristics. Land use features are represented by housing age, living area and land area. Neighbourhood characteristics are represented by population density, property density, housing sale volume density, distance to rail transport stations (nearest access points) and employment accessibility. Assessed price is the dependent variable in all regression models.

Locations of urban rail transport stations (including those under construction) are identified and mapped for the estimation of approximate distance from observed data points to nearest station access points. Locations of several routes and stations in the pipeline are not yet finalised but approximate locations of their stations can be determined. ‘Siam BTS station’ is assigned as the centre point of Bangkok’s CBD as it is currently the busiest location for public transports and commercial activity. A Euclidean distance metric is used in this study.

Given the nature of the housing market, GWR is widely judged to be the most appropriate approach for the analysis. In many housing market studies, it is often assumed that there is spatial heterogeneity in the relationship between house price and hedonic independent variables (Lu *et al.*, 2014). Several comparative studies on housing market and property appraisal (Bitter *et al.*, 2007; Huang *et al.*, 2010; McCluskey *et al.*, 2013) suggest that GWR is superior to other approaches—e.g. artificial neural network and traditional multiple regression analysis—in terms of model performance and accuracy. GWR is also capable of identifying housing submarkets in large study areas (Borst and McCluskey, 2011), which is crucial for the improvement of model accuracy, especially in areas where housing types are diverse and scattered like in Bangkok.

5.7 Limitations and Concerns

Accuracy of sale price data

A primary concern is the accuracy of property sale data provided by the Land Registry. Some reported sale prices may be lower than actual transaction prices because of the incentive to avoid SDLT. A lack of well-established tracking systems has given rise to informal property transaction channels. In a worst-case scenario, property sale price may be registered as low as assessed price, which the law mandated as a minimum taxable value for the SDLT. However, this problem can be addressed by verifying the Land Registry's sale data with the PVB's survey data. The sale data set provided by the PVB has been verified by surveyors, who have approached property owners directly to enquire about asking prices. The two data sets are merged using property ID comprising UTM number, page number and parcel number.

The size of bandwidth in GWR models

The choice of bandwidth—or decay function—has a massive influence on the results of GWR. A narrow bandwidth will lead to high variances in the estimators and, conversely, a wide bandwidth will lead to results that are similar to a global model because it allows for minimal distance decay (Fotheringham *et al.*, 2000). The study demonstrates that, in Equation 5.8, as *b* tends to infinity, the weights are getting close to one so the estimated parameters become uniform, which makes GWR similar to OLS. To determine an appropriate bandwidth size, an adaptive bandwidth is adopted to ensure a non-zero weighting at all regression points, and AIC is used to select the bandwidth.

The problem of multicollinearity

Another problem associated with GWR is the multicollinearity in the models. Brunsdon *et al.*, (2012) point out that collinearity is an inherent problem, which is particularly pertinent in the study of spatial data. The multicollinearity problem occurs when explanatory variables in the model are correlated. The problem is particularly relevant to GWR because collinearity is more pronounced when the localised data samples are smaller. Some localities may exhibit collinearity when the data is spatially heterogenous in terms of its correlation structure (Ibid.).

The problem can be addressed by measuring the degree of collinearity in the data by variance inflation factor (VIF), which estimates the degree to which the sampling variance of each parameter is amplified by the collinearity in other independent variables in a model. VIF values can be computed by the OLS tool prior to the construction of GWR models to decide which explanatory variables should be selected. As a rule of thumb, a VIF value above 7.5 is problematic (Rosenshein et al., 2011), but this depends on what we are trying to estimate. High VIFs may be unproblematic if a straightforward prediction is made by a model. If one variable has a high VIF value, other (one or more) variables will normally have high VIF values because they are correlated. When any variables exhibit excessively high VIF values, the variables can be omitted from the model or more data can be obtained in order to reduce the standard errors. Alternatively, predictors may be recoded using orthogonal polynomials to reduce correlations (Bock, 2019).

Apart from VIF, the OLS tool is used to perform diagnostic tests for overall model selection as well. The Koenker p-value is used to test for nonstationary relationships in a model. A small and statistically significant Koenker p-value means the relationships between variables vary across the study area and are nonstationary. In this situation, robust probabilities should be consulted to determine coefficients.

Modifiable Areal Unit Problem (MAUP)

MAUP is a long-standing concern in spatial analysis, especially in the case of census-type data that involves different levels of aggregation (e.g. county, district, sub-district, etc.). The problem arises when different spatial units are used to mapped the same data, which can produce different analytical results and may lead to misinterpretation of the relationship between variables (Dark and Bram, 2007; D. Wong, 2008). As shown by Openshaw and Taylor (1979), many different possible ways to aggregate spatial units can produce correlations that range between -1.0 and +1.0 even with the same data set.

There are two issues related to the MAUP: scale and zone. The scale problem arises when the data collected at one scale is applied at a different scale, which can produce variation in statistical results. For example, aggregation of individual data tends to produce more tightly clustered regression results and stronger coefficients of determination (O'Sullivan and Unwin, 2010). The zoning problem arises when

different ways of grouping spatial units produce markedly different results from the same data (Openshaw and Taylor, 1979).

The MAUP is certainly an important factor in this study as the assessed and sale prices data has been collected at individual level. In ArcGIS, I have employed data-driven classification (natural breaks) to limit the impact of MAUP in the analysis. However, natural breaks only allow for data-specific classification and are not useful for comparing different underlying data. I have also employed multi-scale data presentations to mitigate distortion effects from the zoning issue. In such cases, data are presented from four different unit scales: borough, sub-district, 1-kilometre grid and 500-metre grid.

Boundary Problem

One methodological limitation often mentioned in studies on spatial point patterns using administrative boundaries concerns the edge effect. The problem involves the failure of spatial models to include the influence of data points outside the study area (Gao et al., 2017; Sadler et al., 2011). These influences exist because people can travel freely across arbitrary borders and locational effects can extend beyond certain boundaries. Researchers often use arbitrary administrative boundaries such as census tracts and block groups without paying careful attention to the fact that resources beyond a given boundary can affect behaviours or values within a given spatial unit (Rodeiro and Lawson, 2005). Edge effects manifest as arbitrary boundaries fail to fully capture these effects, resulting in distortion of estimates. In their study on location modelling within the mass appraisal process, Lockwood and Rossini (2011) assert that using administrative boundaries can lead to a marked difference between the predicted values of adjacent properties located on different sides of such boundaries.

Edge effects can be corrected for in a number of ways. In Ripley's (1979) study, two types of edge corrections are examined. The first approach involves the elimination of border effects by mapping the region on to a torus, and the other involves the inclusion of points lying outside but within a reasonable distance of the study areas. Another method of correcting for edge effects is to create a buffer zone around the study region (Wong and Fotheringham, 1990). Points within the buffer zone are considered in terms of their effect on points within the study regions but not included in the main analysis.

The shape of study regions is a related issue as it may influence statistical results. The nearest-neighbour statistic, for example, tends to measure point patterns as being increasingly clustered when the shape of the region becomes more elongated (Fotheringham and Rogerson, 1993). A possible solution to this issue, and that of edge effects, is to explore a large number of random drawings of shape and sizes of regions within a defined area and carry out significance test for each region (Ibid.). Particularly in the field of property assessment, it is evident that GWR can reduce prediction errors arising from edge effects, and that GWR-based models are more in line with the market (Lockwood and Rossini, 2011). The efficacy of GWR in improving model accuracy is illustrated, for example, by its use in the identification of submarkets by Borst and McCluskey (2008).

5.8 Conclusion

This chapter has sought to explain how three analytical methods—assessment ratio analysis, spatial autocorrelation analysis and GWR—can be applied to property data. Although none of the methods is new to housing studies, this study is unique in terms of the combination and sequence of the methods. Thanks to the generous involvement of the PVB, the scale of the data sets used in this study is unprecedented in property research in Thailand. The data on assessed house prices covers a period of 12 years. By incorporating this data with sale prices, property price determinant variables and cadastral maps, we gain highly comprehensive data sets suitable for property tax analysis at a city-wide scale. Further analysis of these data sets, beyond the scope of this study, would certainly produce results that would contribute to the fields of urban housing economics, urban geography and property valuation.

Particularly in Thailand, there has never been an application of the IAAO's ratio analysis to a study area as holistic as in this study. A/S ratios of properties located in all metropolitan areas of Bangkok are analysed based on all approaches suggested by the IAAO—i.e. LOA, COD and PRD. These approaches are used as a preliminary analysis of the A/S ratio differentials in all Bangkok boroughs. The results of such analysis will allow us to determine and compare assessment coverage throughout the capital city. The results are also compared with those of international studies in terms of assessment performance in large urban areas.

The type of spatial autocorrelation analysis chosen in this study is global and local Moran's I. The global Moran's index is used to identify if there is a spatial autocorrelation in the data. The test is performed on the A/S ratios across the study area. The local test is then performed on the same data at different spatial units. The units of choice are administrative boundaries (borough and sub-district) and artificial grids (1-kilometre and 500-metre). The bivariate local Moran's I is considered in terms of analysing the spatial correlation between A/S ratios and population or housing density. However, it is evident that there is a strong relationship between A/S ratios and housing density. Therefore, only the analysis of univariate local Moran's index on A/S ratios is performed in this study.

GWR is the last approach adopted in this study. As mentioned earlier, GWR is particularly useful in housing and mass appraisal studies because it provides relatively

accurate results (see Bidanset and Lombard, 2014; Lockwood and Rossini, 2011). The use of GWR in property tax modelling can produce more accurate assessments than multiple regression analysis (MRA) or most automated valuation modelling (AVM) techniques (Borst and McCluskey, 2008; McCluskey et al., 2013; Moore, 2009). Before performing the GWR analysis, OLS is used as a diagnostic test to perform two tasks. One is to determine the appropriate set of variables and the other is to ensure a nonstationary relationship in each model. GWR is then performed using the selected set of variables to determine their influence on assessed prices.

Finally, the limitations in this study are identified in Section 5.7. There are five limitations ranging from the quality of data to methodology-related concerns. The solution to the issue of sale price data quality is to cross-validate the data of the Land Registry with the PVB's survey data. This step is carried out in the data cleansing process. The methodology-related problems include the size of bandwidth in GWR models, the problem of multicollinearity, MAUP and edge effect. Solutions to these problems are drawn from the literature. Some solutions discussed are applied and will be presented in the remaining chapters.

The last two chapters (6 and 7) present data analysis and discussion of research findings. Chapter 6 explains how the data is analysed by the three methods. Before the presentation of the main analysis, the chapter provides an overview of the assessed price in relation to the sale price data. The data covers all areas of Bangkok. The final chapter provides a summary and discussion of findings in relation to the research questions and hypotheses. The thesis concludes with research implications and recommendations with the aims of improving assessment processes and setting a direction and framework for future studies.

Chapter 6 Data Analysis and Results

In this chapter we will explore the housing market in Bangkok through both spatial and non-spatial analyses of property data. The main aim is to reveal irregularities in assessed price, and to see whether they have caused any systemic inequities or not. I attempt to test for both horizontal and vertical equities, for which the analysis is three-fold. The first is ratio analysis, which measures assessment equity on a broad scale—i.e. borough level. This conventional approach is powerful in that, if the sale price data is accurate, A/S ratio analysis can produce meaningful results for assessment levels at certain areal scales. The analysis is akin to the assessment coverage ratio in the simple ratio model of Bahl and Linn (1992). Spatial autocorrelation analysis (local Moran's I) is then applied at property level to identify more specific areas with underlying assessment problems. Finally, GWR is performed to explore the impact of explanatory variables on housing assessed prices. Two GWR models are presented and discussed.

There are five main parts to this chapter. The first section (6.1) provides a descriptive account of housing assessed prices. It includes an overview of assessed prices between 2008 and 2019, which covers three assessment cycles. The second section (6.2) presents the assessment ratio analysis at borough level, with maps to facilitate comparison of results between boroughs. The third section (6.3) shows how spatial autocorrelation analysis is performed on A/S ratios. The presentation of the results of local Moran's I is based on four areal units and on area-specific boundaries. In the fourth section (6.4), OLS diagnostic testing and GWR analysis are presented. This section also makes use of maps to show the spatial distribution patterns of selected explanatory variables. This chapter is concluded with Section 6.5 to provide a summary of findings.

6.1 Overview of the Assessed Prices in Bangkok, 2016-19

In order to understand the working of the whole assessment process, we will first examine spatial distribution of assessed price for all types of properties. This preliminary analysis includes land values of nearly all private properties in Bangkok. The purpose of this analysis is to see how assessed prices are distributed geographically over the entire BMA. Five types of property—as classified by assessors—are presented in the data set. The most predominant property type in terms of the number of units is residential, which accounts for about two-thirds of the total units. The rest comprises commercial, agricultural, industrial and vacant land.

In Figure 6.1, overall levels of current assessed (vacant) land values are presented at 500-metre grid scale (b) along with property density (a). The results reveal a concentration of highly assessed properties in the CBD and peripheral boroughs along the river banks. There are more properties with assessed values higher than the mean (11,916 baht or £264.8 per square metre) located on the east side. The spatial distribution of assessed prices is consistent with that of property density except in the two easternmost boroughs, Lad Krabang and Nong Chok, where more industrial properties are located.

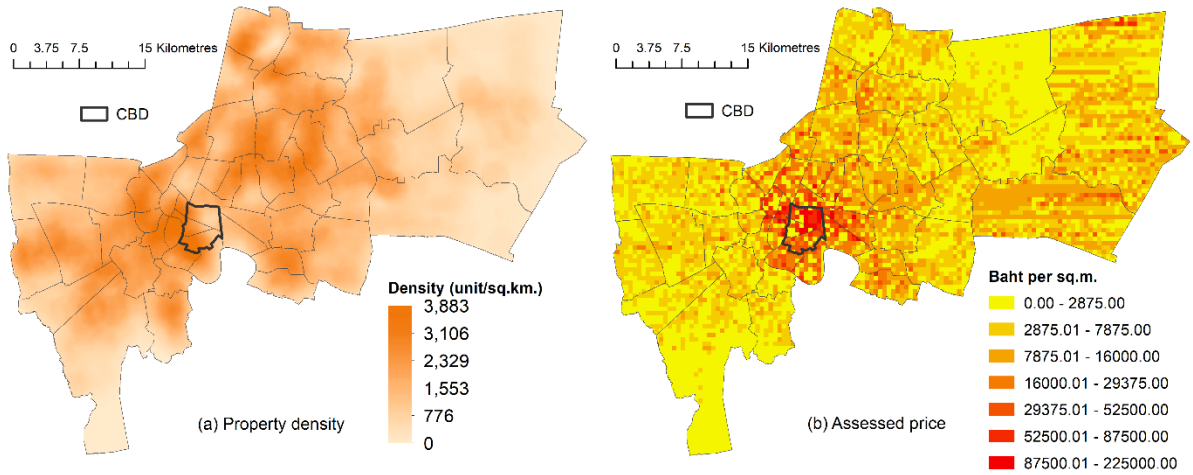

Figure 6.1 Property density and assessed land values in Bangkok (all types of properties), 2016-19

When comparing the spatial distributions of assessed (vacant) land values of residential properties with those of all types of properties, it is found that, in general, they are similar in western suburban and central areas (see Figure 6.2). However, there are some disparities in assessed land values that should be mentioned. As compared to

total assessed land values, properties with lower residential assessed land values are largely found in the two easternmost boroughs, Lad Krabang and Nong chok. It is possible that high assessed values in these boroughs have been caused by industrial properties and vacant lands as they altogether account for the majority of all properties in the areas. Low residential assessed values in Parthum Wan district located in the CBD have raised a concern over systemic errors in assessed prices, which will be further investigated in the following sections. Another observation is that highly assessed residential land values are located in suburbs of both sides of the river, but more concentrations of the high assessed values can be found on the east side. This in part confirms my hypothesis that the east side of Bangkok has become a more attractive location for residential units than the west because it has better accessibility to employment and commercial centres as well as government agencies.

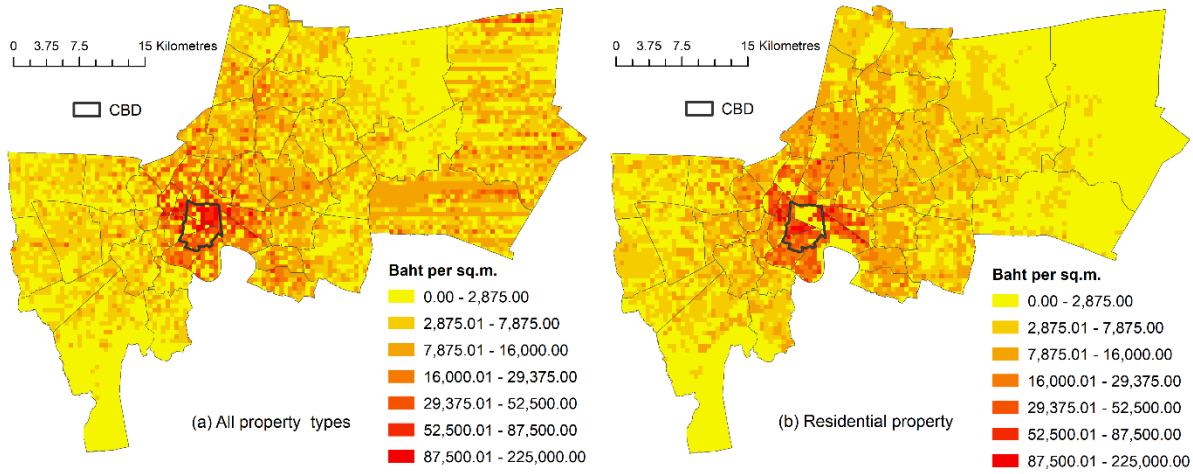

Figure 6.2 Assessed land values in Bangkok, 2016-19

Bangkok has seen major changes in urban development and public transport during the past few decades (Perera et al., 2007). These changes have not gone unnoticed by residents and investors, and the housing market in Bangkok has been more or less affected by these factors. Sale prices of residential properties are assumed to have been adjusted according to these factors, but the extent to which assessed price can adjust to the changing market circumstances remains questionable. We will now turn our attention to assessed prices for residential properties in their entirety, which include land and improvement values.

Using data from the current assessment cycle, Table 6.1 presents descriptive statistics for assessed values of residential properties. Thirty-three of the city's fifty boroughs have mean assessed house prices higher than the overall mean assessed price for Bangkok. What we can notice from the results is that there is a marked difference between the highest and lowest assessed prices per square metre, 269,628 baht and 341 baht (about £5,991 and £7.6 per square metre respectively). Boroughs with marked differences are mostly located in inner Bangkok. The borough with the largest difference in housing assessed values is Dusit (255,052 baht or £5,668 per square metre), compared with Sai Mai, which is the outer suburban borough with the smallest difference of 12,750 baht or £284 per square metre. Albeit not totally conclusive, we can make a general observation that inner Bangkok and some areas in eastern suburbs tend to have wider disparity in housing assessed prices than other areas. Is this phenomenon a direct result of particularly higher transaction prices in those areas?

When comparing assessed with sale values of residential properties, it is found that they have similar patterns of geographical price distribution (see Figure 6.3). The only difference is that the sale prices seem to be significantly higher in suburban areas on both sides of the city, which confirms my hypothesis that assessed prices are catching up with sale prices. The housing sale prices tend to have larger disparities between the highest and the lowest values in the same areas as the assessed prices. These areas are located in inner Bangkok, which also includes most parts of the CBD. However, a major difference between the two data sets is that the sale prices have significantly bigger ranges than the assessed prices have in all boroughs (see Table 6.2). In Dusit, for example, the range of sale prices is 431,210 baht (£9,582), nearly twice as much as that of assessed prices of 255,052 baht (£5,668).

Table 6.1 Summary of housing assessed prices (baht/m^2) in Bangkok

Borough	Mean	Median	Minimum	Maximum
Bang Bon	15,566.73	15,578.13	3,572.08	27,952.81
Bang Kapi	14,040.63	13,178.67	2,232.75	43,158.13
Bang Khae	15,469.24	15,376.32	3,007.00	26,270.84
Bang Kho Leam	40,062.97	39,142.20	10,223.44	80,884.68
Bang Khun Thian	13,253.86	13,137.24	778.82	33,010.92
Bang Na	18,128.82	17,238.78	4,232.75	49,402.54
Bang Plat	16,230.91	14,660.77	3,956.39	52,708.70
Bang Rak	42,260.33	34,675.21	10,056.42	258,984.00
Bang Sue	20,900.90	18,770.58	2,865.10	73,715.91
Bangkean	7,733.49	7,500.00	800.00	42,372.88
Bangkok Noi	17,684.06	15,535.38	3,870.56	56,864.00
Bangkok Yai	17,218.59	17,681.94	2,627.58	34,831.52
Bueng Kum	15,069.10	13,718.32	404.17	57,686.48
Chatuchak	17,360.17	15,976.67	3,430.04	85,548.80
Chom Thong	20,348.36	19,902.24	2,230.83	33,614.58
Din Dang	20,601.07	18,375.13	3,077.63	71,635.00
Don Mueang	13,889.12	13,657.26	2,607.39	73,574.36
Dusit	48,919.99	44,170.78	14,576.20	269,628.80
Huai Khwang	21,662.78	17,429.01	8,143.85	108,558.35
Khan Na Yao	15,408.92	14,632.75	746.35	36,083.33
Klong Sam Wa	11,106.03	10,861.30	534.55	25,202.72
Klong San	23,613.60	20,493.30	2,652.35	251,249.24
Klong Toei	34,179.85	31,797.52	2,587.62	94,690.29
Lad Krabang	10,806.54	10,422.18	365.57	42,508.11
Ladprao	16,809.52	15,397.44	2,241.89	71,467.14
Lak Si	15,866.20	14,992.44	4,857.69	39,880.74
Min Buri	11,112.96	10,838.49	838.88	31,815.79
Nong Chok	6,909.30	6,796.95	341.15	41,506.15
Nong Kheam	12,240.30	12,076.41	1,082.29	22,169.10
Parthum Wan	49,467.65	45,235.38	17,041.20	108,814.05
Phasi Charoen	13,813.65	12,861.75	2,062.21	96,888.11
Phra Khanong	17,054.49	15,012.00	4,528.60	87,647.06
Phra Nakhon	60,115.63	55,946.35	15,822.20	112,986.55
Phya Thai	25,507.98	21,872.78	6,676.65	165,219.63
Pom Prap Sattru Pai	67,964.12	63,638.07	20,577.86	146,714.79
Prawet	16,903.64	16,652.92	762.24	84,417.89
Rat Burana	14,243.17	14,833.30	1,619.57	75,118.85
Ratchathewi	48,530.94	40,647.94	9,555.37	131,905.60
Sai Mai	7,588.47	7,375.00	1,000.00	13,750.00
Samphanthawong	81,479.32	65,195.25	16,728.00	188,250.00
Saphan Sung	15,898.51	16,152.16	840.29	31,100.00
Sathorn	42,809.11	41,604.00	14,229.17	104,443.43
Suanluang	22,569.76	23,108.14	1,595.64	102,497.94
Taling Chan	17,039.37	13,672.85	1,915.63	45,881.25
Thawi Watthana	12,778.71	11,903.24	1,564.40	28,210.59
Thon Buri	19,460.46	17,043.77	4,160.74	57,850.46
Thung Kru	16,167.59	15,656.85	3,601.32	67,770.43
Vadhana	53,964.68	47,163.72	6,004.99	189,361.02
Wang Thong Lang	22,798.30	23,521.29	4,147.75	35,192.27
Yannawa	43,269.89	41,054.26	12,855.71	94,932.62
Total	15,816.96	13,735.63	341.15	269,628.80

Source: PVB (2012, 2016b)

Table 6.2 Summary of housing sale prices (baht/ m^2) in Bangkok

Borough	Mean	Median	Minimum	Maximum
Bang Bon	26,558.92	23,717.46	4,237.29	60,000.00
Bang Kapi	21,970.52	18,055.56	2,000.00	133,792.05
Bang Khae	27,091.32	25,875.00	2,000.00	83,710.41
Bang Kho Leam	55,765.63	45,454.55	10,000.00	158,940.40
Bang Khun Thian	21,456.06	20,793.27	625.00	84,102.01
Bang Na	23,569.61	18,750.00	3,518.52	82,599.12
Bang Plat	19,965.58	18,416.79	2,500.00	72,580.65
Bang Rak	52,004.33	41,666.67	7,352.94	831,513.28
Bang Sue	31,308.74	24,193.55	136.14	156,250.00
Bangkean	19,770.00	16,992.34	623.44	61,205.27
Bangkok Noi	28,933.77	26,388.89	2,439.02	116,666.67
Bangkok Yai	35,013.54	38,618.38	2,535.50	71,948.36
Bueng Kum	26,619.43	21,199.28	611.11	95,291.48
Chatuchak	23,179.09	17,723.88	2,252.25	116,033.76
Chom Thong	39,071.10	38,760.50	2,255.64	82,048.46
Din Dang	32,395.90	27,573.53	5,000.00	418,019.48
Don Mueang	23,303.67	24,254.81	2,419.35	66,236.41
Dusit	63,155.10	52,419.35	11,267.61	442,477.88
Huai Khwang	34,567.25	25,000.00	6,944.44	264,084.51
Khan Na Yao	28,035.53	27,525.93	829.65	89,473.68
Klong Sam Wa	17,294.65	16,666.67	300.00	61,576.35
Klong San	33,151.37	27,978.55	2,500.00	308,823.53
Klong Toei	60,999.16	39,195.88	5,375.00	396,153.85
Lad Krabang	17,012.19	17,098.04	380.89	74,239.13
Ladprao	26,244.15	20,333.33	675.68	101,878.61
Lak Si	32,873.87	22,947.26	1,328.99	76,492.54
Min Buri	14,835.46	13,949.58	892.86	38,709.68
Nong Chok	9,417.10	9,040.89	305.62	25,953.13
Nong Kheam	14,902.06	14,062.50	1,262.63	41,666.67
Parthum Wan	70,685.97	51,419.35	9,615.38	622,679.86
Phasi Charoen	19,958.50	16,666.67	1,470.59	68,965.52
Phra Khanong	23,889.06	18,687.71	4,098.36	112,303.28
Phra Nakhon	84,856.47	67,307.69	8,610.79	464,876.03
Phya Thai	46,447.96	32,894.74	4,000.00	354,166.67
Pom Prap Sattru Pai	101,992.66	71,847.10	12,931.03	927,083.33
Prawet	29,897.06	31,291.95	1,233.87	77,586.21
Rat Burana	22,546.91	19,673.81	1,013.51	66,875.00
Ratchathewi	77,752.03	55,070.12	6,622.52	422,654.27
Sai Mai	22,079.19	23,236.89	943.40	55,110.50
Samphanthawong	156,292.08	97,348.48	22,026.43	1,342,105.26
Saphan Sung	26,122.01	27,086.82	1,374.48	71,995.19
Sathorn	52,829.71	44,326.24	9,661.84	175,000.00
Suanluang	37,858.48	35,287.08	2,500.00	129,629.63
Taling Chan	29,641.03	26,666.67	1,250.00	100,000.00
Thawi Watthana	18,142.80	17,187.50	1,458.33	51,470.59
Thon Buri	24,519.03	23,121.39	2,654.87	91,743.12
Thung Kru	25,688.77	24,444.44	4,000.00	65,625.00
Vadhana	122,227.18	80,604.62	4,539.95	1,029,109.59
Wang Thong Lang	50,864.37	47,621.11	2,875.00	138,888.89
Yannawa	66,690.73	51,470.59	10,000.00	220,175.44
Total	26,560.11	22,580.65	136.14	1,342,105.26

Source: Land Registry (2016)

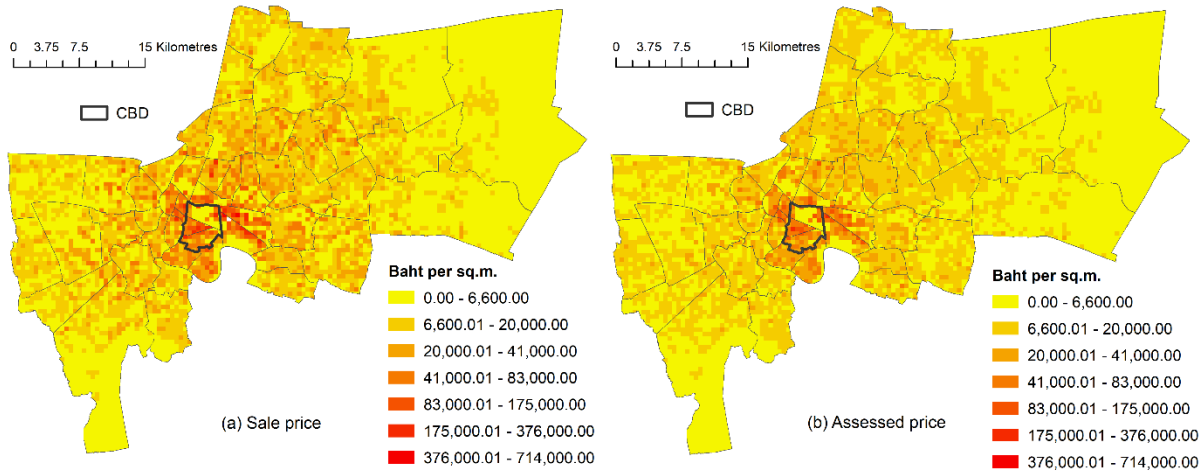

Figure 6.3 Sale and assessed prices of residential properties in Bangkok, 2016-19

6.1.1 Changes in Housing Assessed Prices in Bangkok, 2008-19

In this section we will investigate how assessed price has changed throughout Bangkok during the past twelve years, from 2008 to 2019. During this period, there have been two formal reassessments of all properties in the country, one in 2011 and the other in 2015. Properties sale data that were used in both reassessments had been collected several times before final assessments were carried out. This has raised a question about the timing of market price adjustments, which may not be consistent throughout the whole data set and geographical areas of Bangkok.

In addition, the timing of property surveys has raised another concern over the assessments. Property assessment surveys are based on geographical area, which means that most properties in each borough had been inspected at different time periods. The time period between the first and last surveys can extend over two years due to limited manpower of the PVB. As Person A, a manager in the East Bangkok assessment division, put it:

> There are only 28 staff in my division who are responsible for the assessment of over one million land parcels. The assessment process must be completed within three years. It begins with data validation, property surveying, data analysis, assessed price determination and cadastral map preparation. Every step requires careful attention to property details because the data we receive from the Land Registry is not always up-to-date. So assessors have to check the map parcel by parcel.

The 50 boroughs of Bangkok are grouped into 17 areas according to the boundaries defined by the Land Registry's offices. There are two divisions of assessors, one is responsible for west Bangkok (seven areas) and the other is responsible for east Bangkok (ten areas)—see Table 6.3 for details. Each assessing division works on different geographical areas and assessors work in one area to another at different time; therefore, it is possible that properties are assessed differently according to locations. As Person B, an assessor in the West Bangkok assessment division, put it:

> First we choose the area that we have to work on based on the boundaries defined by the Land Registry, which are larger than administrative boundaries. We work area by area until the whole assessment process is complete. Roughly a year before the announcement of new assessments, we review the prices and update sale price data for every area. And again, this is carried out one area at a time.

Changes in assessed prices (in percentage terms) over three assessment cycles are presented at 500-metre grid level in Figure 6.4 (a-b). In general, the results suggest that significant increases in assessed prices between the 2008-11 and 2012-15 cycles are distributed evenly throughout Bangkok except in seven suburban boroughs in the east—with blue outline in Figure 6.4 (a). Some decreases and slight increases in assessed prices in these boroughs are irregular relative to the price adjustment patterns in the rest of Bangkok. In the subsequent assessment cycle (2015-19), there are fourteen boroughs with irregularities in assessed price adjustments, which are located in the west and inner Bangkok—with blue outline in Figure 6.4 (b). Changes in assessments in these boroughs are relatively low compared to the rest of Bangkok. The results confirm my hypothesis that assessors tend to average out assessed values to avoid complaints and assessment appeals. Assessed values of the properties that were substantially raised in the previous assessment cycle tend to remain unchanged in the next cycle to allow for other properties to catch up.

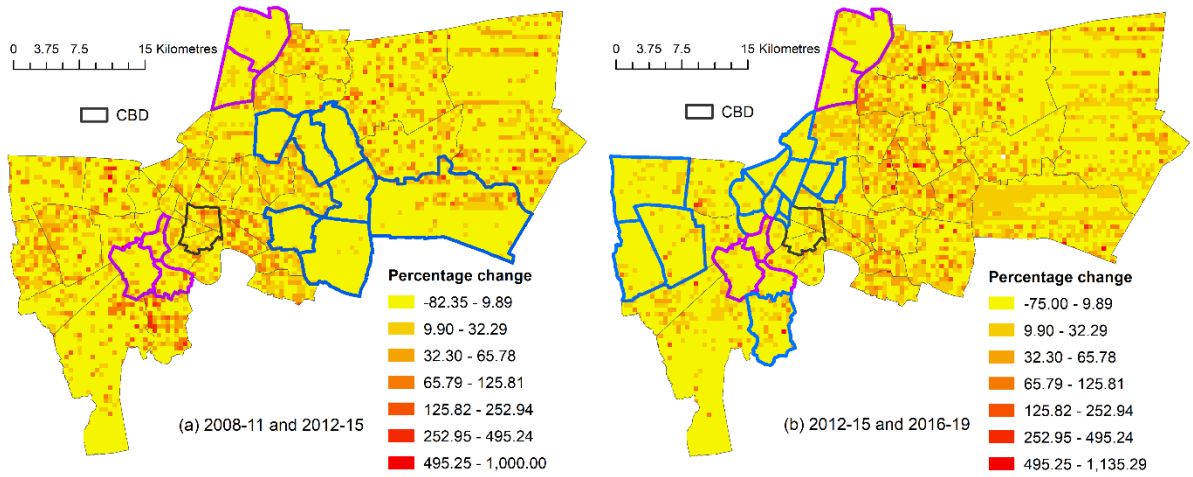

Figure 6.4 Percentage changes of assessed prices over three assessment cycles (2008-19)

The results also reveal particular areas in Bangkok in which assessed prices have changed relatively slowly. These residential properties are located in five boroughs with purple boundaries shown in Figure 6.4 (a and b). If we compare the results to changes in the housing market price during the same period, we find that the assessment levels in five out of six boroughs indicate a certain degree of inconsistency. In Lak Si and Don Mueang (boroughs in north Bangkok), for example, the average change in assessed prices between the 2008-11 and 2012-15 assessment cycles is only 6.06 per cent, compared with the average change for Bangkok of 26.15 per cent. Between the 2012-15 and 2016-19 assessment cycles, the average change in assessed prices in the two boroughs drops to 3.35 per cent, compared with the whole Bangkok's average of 17.22 per cent. This evidence confirms the variability in assessed values that, to some extent, appears to be location specific.

Apart from these observations, there have been more significant increases in housing assessed prices in the east than in the west side of Bangkok. The growth in assessed prices during the past eight years has been largely caused by properties located along newly developed urban rail transit lines (REIC, 2019). Interestingly, these new lines are not only limited to the east side, and in fact the developments are even more intensive in west Bangkok. There are thirteen boroughs in west Bangkok that contain newly constructed rail transit lines, compared with ten boroughs in east Bangkok. Why do housing assessed prices in east Bangkok seem to be more sensitive to the urban rail transit developments than other areas? In order to answer this question, we need to

carry out further analyses on sale prices and other factors that have an influence on the housing market, which will be presented in the following sections.

Table 6.3 Areas of assessment

Assessment division	Land registry office	Borough
Division 1 (West Bangkok)	Inner Bangkok	Phra Nakhon
		Dusit
		Pom Prap Sattru Pai
		Parthumwan
		Bang Rak
		Samphanthawong
		Yannawa
		Bang Kho Leam
		Sathorn
	Bang Khen	Bang Khen
		Sai Mai
	Bang Khun Thian	Bang Khun Thian
		Chom Thong
		Bang Bon
	Bangkok Noi	Bangkok Noi
		Taling Chan
		Bang Plat
		Thawi Watthana
	Thon Buri	Thon Buri
		Klong San
		Bangkok Yai
		Rat Burana
		Thung Kru
	Don Mueng	Don Mueng
		Lak Si
	Nong Kheam	Nong Kheam
		Phasi Charoen
		Bang Khae
Division 2 (East Bangkok)	Phra Khanong	Phra Khanong
		Klong Toei
		Bang Na
		Vadhana
	Bang Kapi	Bang Kapi
		Wang Thong Lang
	Chatuchak	Chatuchak
		Bang Sue
	Ladprao	Ladprao
	Bueng Kum	Bueng Kum
		Saphan Sung
		Khan Na Yao
	Lad Krabang	Lad Krabang
	Min Buri	Min Buri
		Klong Sam Wa
	Huai Khwang	Huai Khwang
		Phya Thai
		Ratchathewi
		Din Dang
	Prawet	Prawet
		Suanluang
	Nong Chok	Nong Chok
Total	17	50

Source: Author's summary from the interviews

6.2 Assessment Ratio Analysis

The uniformity of assessed prices is measured among different boroughs by comparing median A/S ratios. An A/S ratio for each observed property is calculated from transactions that occurred between 2008 and 2017, which covers three assessment cycles. Sale prices used in the calculation are consistent with the assessment timing—selected transactions occurred before assessments became effective. There are 69,724 residential properties included in the ratio analysis.

The IAAO standards call for the upper and lower bound of the 95 per cent confidence interval of the median A/S ratio to be between 0.90 and 1.10 (IAAO, 2013b). Properties with A/S ratios below 0.90 are generally considered under-assessed, and properties with ratios above 1.10 are considered over-assessed. Properties with ratios falling within the 0.90 to 1.10 range are generally considered to be accurately assessed.

A histogram of A/S ratios is shown in Figure 6.5. The distribution of A/S ratios confirms that, in general, housings in Bangkok were under-assessed. They were assessed on average at 72 per cent of their reported sale prices, with the minimum and maximum A/S ratios of 0.10 and 1.99 respectively. Residential properties that met the IAAO standards (with A/S ratios ranging from 0.90 to 1.10) account for 17.9 per cent of total properties under observation, of which 74.88 per cent were under-assessed (less than 0.90) and 7.22 per cent were over-assessed (over 1.10).

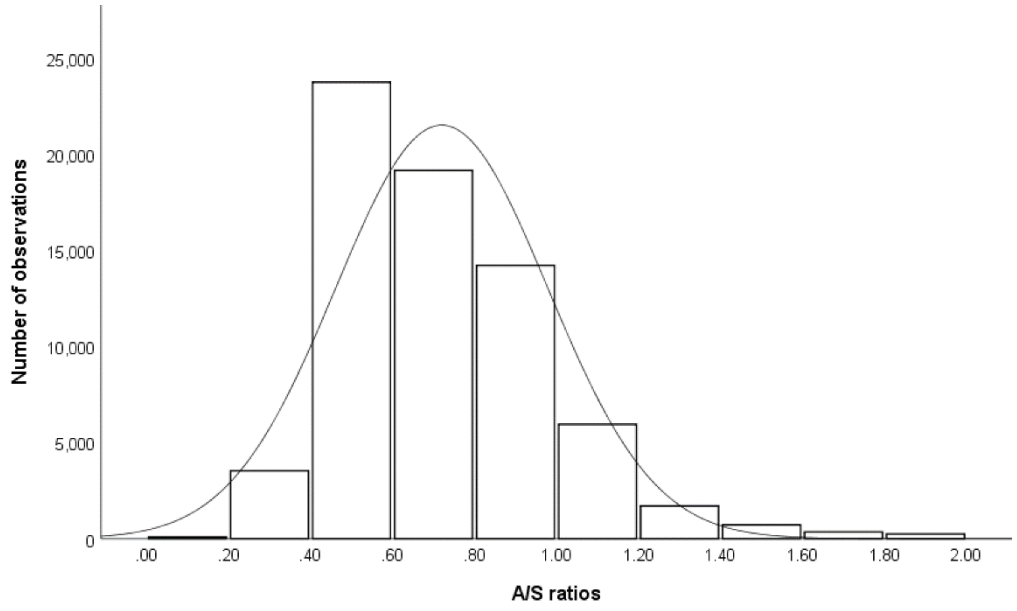

Figure 6.5 Histogram of A/S ratios

When comparing properties from different sale price levels, it is found that the top 10 per cent of properties have an average A/S ratio of 0.49, while the bottom 10 per cent have an average A/S ratio of 1.03. The results indicate that on average higher-value properties were relatively under-assessed by just over half of their market value. If we look at the distribution of A/S ratios across the entire price range, it is evident that the ratios reduce as property market values increase (see Table 6.4). The average A/S ratio of properties in the fifth quintile is not much more than half that of properties in the first quintile. Given similar tax rate structure for all property values and assuming that sale prices represent market value and reflect property wealth, assessment inequities arise as people who possess less wealth have higher property tax liability.

Table 6.4 Measures for A/S ratios as defined by sale prices

Properties within:	A/S ratio:			
	Mean	Minimum	Maximum	Number of observations
1st Quintile	0.9857	0.1560	1.9972	14,259
2nd Quintile	0.8172	0.1572	1.9977	13,666
3rd Quintile	0.6669	0.2011	1.9917	13,909
4th Quintile	0.5891	0.1186	1.9448	13,929
5th Quintile	0.5371	0.1004	1.9479	13,961

Source: Land Registry (2016) and PVB, (2016b)

From a geographical perspective, it can be seen in Table 6.5 that on average none of the properties in any Bangkok boroughs is being over-assessed, as median A/S ratios for all boroughs are less than one. Among all boroughs, only the following five boroughs have upper and lower bounds of median A/S ratios that meet the IAAO standards: Pom Prap Sattru Phai, Phra Nakhon, Parthum Wan, Bang Rak, and Chatuchak. Four of these are within the inner Bangkok area, and they are very similar in terms of economic development and social settlement. Phra Nakhon and Pom Prap Sattru Phai are the site of some of the most historically important buildings and famous tourist attractions such as the Grand Palace, Wat Phra Kaew (Temple of Emerald Buddha) and Khaosan Road. Adjacent to each other, Bang Rak and Parthum Wan occupy the main part of the core CBD where high-value office buildings and big shopping centres are located.

Located just outside the inner Bangkok area, Chatuchak has been prioritised as a transportation hub, including interchange stations for the BTS and MRT, coach stations, and several major highways to the northern and western provinces. Recent

developments in the urban rail transport hub have been built in Bang Sue, which is a borough adjacent to Chatuchak. The area has recently become a popular location for office buildings, as well as several mixed-use developments ranging from commercial to high-rise residential properties with a high unit per area ratio.

The tendency that properties in suburban areas of Bangkok are generally under-assessed is evident in the map of median A/S ratios (Figure 6.6). Lower median A/S ratios are located in both eastern and western suburbia of Bangkok. These areas, particularly in the east, have been destinations for urban sprawl since the late 1980s due to rapid economic growth, rural-urban migration and urbanisation. The development process had been largely shaped by the first Bangkok Master Plan (1992) and urban land expropriation policy[9]. Covering the total distance of 94 kilometres, the three stages of expressway in BMA have connected the eastern and northern suburbia to the downtown and the southern suburban areas. However, as a result of unplanned conversion of eastern fringe's vacant lands into urban land use and inexorable rise in car ownerships, people living in these suburban areas have been suffered from serious traffic congestion, especially when travelling to and from employment hubs in the downtown (Pongsawat, 1995).

What the results suggest is that high-value residential properties in suburban areas tend to be under-assessed. Some might assume that these under-assessed properties are large detached houses because of their suburban locations, but in fact they are not. An examination of housing types in each price range reveals that terraced houses are the most under-assessed property type, and account for 37 per cent of the total properties in the fifth quintile, while detached houses account for only 10 per cent. In the first quintile, however, there are approximately the same number of terraced houses and detached houses that were over-assessed, each of which account for 30 per cent of the total properties. The number of detached houses that fall in the first quintile is relatively high as they account for 18.6 per cent of the total observations.

[9] Expropriation of Immobile Property Act 1987 gives the government power to expropriate private properties for public purposes, which largely involve the construction of the expressway systems (toll way) aiming at alleviating traffic congestion in Bangkok.

Table 6.5 Median A/S ratios in 50 Bangkok boroughs

Borough	95% Confidence Interval for Median			
	Median	Lower Bound	Upper Bound	Sample Size
Wang Thong Lang	0.459	0.431	0.483	683
Bangkok Yai	0.489	0.458	0.528	234
Chom Thong	0.529	0.515	0.551	965
Lak Si	0.565	0.527	0.594	1,108
Prawet	0.566	0.564	0.569	4,317
Khan Na Yao	0.569	0.565	0.583	1,543
Bang Khae	0.579	0.573	0.582	2,065
Don Mueang	0.591	0.585	0.597	4,715
Taling Chan	0.594	0.554	0.638	461
Bueng Kum	0.614	0.594	0.630	2,593
Saphan Sung	0.627	0.616	0.636	2,332
Thung Kru	0.629	0.614	0.644	1,588
Bang Bon	0.635	0.617	0.656	809
Bang Khun Thian	0.638	0.630	0.639	4,893
Lad Krabang	0.644	0.639	0.649	3,254
Vadhana	0.644	0.523	0.767	264
Sai Mai	0.651	0.643	0.656	5,221
Rat Burana	0.658	0.621	0.681	1,194
Klong Sam Wa	0.667	0.655	0.680	4,302
Suanluang	0.669	0.662	0.672	2,989
Bangkok Noi	0.672	0.591	0.787	293
Bang Kapi	0.722	0.697	0.741	2,143
Nong Chok	0.742	0.733	0.748	1,257
Thawi Watthana	0.745	0.714	0.768	591
Din Dang	0.749	0.706	0.789	706
Phya Thai	0.760	0.669	0.830	299
Ladprao	0.762	0.740	0.786	1,515
Min Buri	0.763	0.753	0.778	1,914
Phasi Charoen	0.770	0.737	0.792	615
Bang Khen	0.786	0.762	0.802	3,278
Huai Khwang	0.793	0.749	0.829	648
Yannawa	0.821	0.773	0.864	517
Dusit	0.822	0.771	0.945	103
Ratchathewi	0.827	0.731	0.871	182
Klong San	0.839	0.809	0.859	532
Klong Toei	0.846	0.736	0.928	200
Nong Kheam	0.869	0.862	0.880	2,472
Phra Khanong	0.872	0.819	0.912	553
Bang Sue	0.875	0.839	0.918	835
Bang Kho Leam	0.885	0.743	0.953	130
Thon Buri	0.903	0.847	0.925	156
Bang Na	0.907	0.876	0.937	543
Samphanthawong	0.924	0.804	0.973	112
Bang Plat	0.930	0.871	0.978	104
Chatuchak	0.931	0.915	0.945	1,227
Sathorn	0.947	0.854	1.000	99
Bang Rak	0.950	0.926	0.966	1,046
Parthum Wan	0.956	0.916	0.996	114
Phra Nakhon	0.958	0.899	0.995	147
Pom Prap Sattru Phai	0.982	0.924	0.999	179

Source: Author's calculations

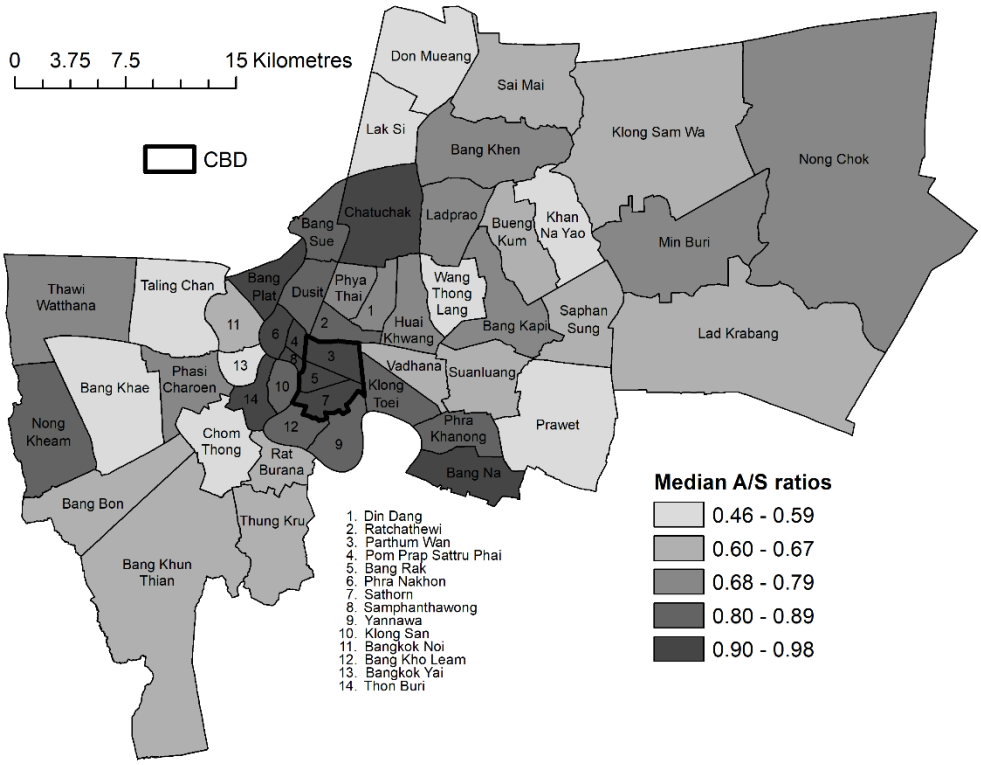

Figure 6.6 Choropleth map of median A/S ratios in 50 Bangkok boroughs

One plausible explanation for higher A/S ratios in the downtown area is that assessment practice does not normally differentiate between residential and commercial properties (PVB, 2009). Given vaguely defined land use patterns in downtown Bangkok where residential units are situated among other land uses, either in the same building (mostly shophouses) or on the same street as commercial units, property transactions of all types of land use included in assessment processes are grouped together (Chiamprasert, 2014). Assessors then adopt a street value assessment approach, in which properties on the same street are given the same value regardless of their types. Therefore, the gap between assessed and sale prices of properties in the downtown areas tend to be smaller than those in suburban areas where relatively few commercial properties exist.

Property assessment levels in inner suburbs that are within BTS/MRT catchment areas—e.g. Chatuchak and Bang Sue—are higher than in other inner suburbs such as Wang Thong Lang and Bang Kapi, which were located outside the BTS/MRT catchment areas when the assessment took place. It is found that median A/S ratios in boroughs located within the catchment areas are all above Bangkok's average of 0.744,

but the A/S ratios of properties located within the BTS/MRT catchment areas remain lower than the average. This could in part confirm the lag of assessed price caused by imperfection in the property assessment process, in which the increase in assessed price tends to be consistent in all areas in order to avoid complaints and appeals, which increase workloads for assessors. Substantial increases in assessed prices in particular areas, even with the support of market evidence, would raise questions from the property valuation committee. Person C, a senior figure in the PVB, mentioned that:

> …In general, assessors have to report to the committee the percentage changes in assessed prices in each area. The committee members usually focus on the areas with the most significant increase in the prices, asking for the underlying causes. Assessed price adjustments normally sit between 20 and 30 per cent.

Average housing assessed prices in Bangkok increased by 22 per cent between 2008 and 2017, while average housing market prices increased by at least 40 per cent during the same period (Bank of Thailand, 2018). This discrepancy has exacerbated the under-assessment problem, especially in an assessment system with infrequent reassessments and practices that tend to limit the increase in assessed values.

During the past decade, there has been significant development in urban rail transport (Thansettakij, 2016). There is ongoing construction of seven additional lines of MRT, BTS and rapid train services, and three additional lines of urban rail transport are in the pipeline (their routes have been announced). These urban rail developments have significantly affected market house price in suburban areas. Average house price inflation in outer Bangkok between 2013 and 2015, during which time a plan to build ten new urban rail lines was announced, was about 8 per cent per year, compared to the average increase of 2.9 per cent per year between 2010 and 2012, and 4.5 per cent per year between 2016 and 2017 (Bank of Thailand, 2018). Despite two reassessments during the period, the data suggests that assessed prices have failed to catch up with the increase in market prices.

The proportion of properties with A/S ratios within the IAAO standard range as well as the proportions of over- and under-assessed properties are presented in Table 6.6. Over half the observations in forty out of fifty boroughs are under-assessed. This is also shown in the map of the proportion of assessment ratios meeting the IAAO standards (Figure 6.7). Most suburban boroughs have a higher proportion of under-assessed

properties (top 28 boroughs in Table 6.6). The proportion of under-assessed properties ranges from 64 to 94 per cent of total observations.

The results also indicate that boroughs with over 90 per cent of properties being under-assessed are suburban areas that are not far from the core CBD. This includes Suanluang, Chom Thong, Bang Khae, Prawet and Wang Thong Lang. However, these areas are notorious for severe traffic congestion as they have relatively high densities of residential units owned by middle-income households who travel to work in the downtown by private car. Road networks in these areas are limited to small alleys, and there are only a few main roads and expressways that link the areas with the CBD. Since the planned urban rail transport expansions in the areas were announced in 2013, house price inflations have increased considerably. During the transition of assessment cycles, assessed prices failed to catch up with increases in market prices resulting from speculations. This suggests that under-assessment of properties might in fact have been caused by systemic assessment problems—e.g. regulations concerning assessed price cap and assessment practices—rather than the quality of sale price data.

Moreover, as shown in Figure 6.7, there is a clear pattern of a higher proportion of accurately assessed properties in inner Bangkok than in outer boroughs. All inner boroughs have a proportion between 27 and 44 per cent compared to the average of 23 per cent for the entire of Bangkok. Inner suburban areas such as Chatuchak and Huai Khwang that have gone through early developments of advanced rail transport infrastructures have relatively high proportions of accurately assessed properties compared to other inner suburban boroughs that have undergone subsequent developments of similar infrastructures.

Table 6.6 Proportion of A/S ratios meeting IAAO standards in 50 Bangkok boroughs

Borough	Under-assessed	Meet Standards	Over-assessed
Suanluang	94%	4%	2%
Chom Thong	94%	5%	1%
Bang Khae	93%	6%	2%
Prawet	92%	6%	2%
Wang Thong Lang	91%	8%	2%
Thung Kru	87%	10%	3%
Bang Bon	87%	11%	2%
Saphan Sung	84%	13%	3%
Khan Na Yao	83%	13%	4%
Bang Khun Thian	81%	14%	5%
Don Mueang	80%	14%	6%
Nong Chok	79%	14%	6%
Lad Krabang	83%	15%	3%
Taling Chan	75%	15%	10%
Bangkok Yai	74%	15%	10%
Lak Si	73%	16%	12%
Bueng Kum	78%	17%	5%
Klong Sam Wa	78%	18%	5%
Sai Mai	77%	18%	6%
Rat Burana	71%	18%	11%
Thawi Watthana	72%	19%	9%
Bangkok Noi	66%	21%	13%
Phasi Charoen	66%	23%	12%
Min Buri	65%	25%	9%
Ladprao	65%	25%	9%
Bang Kapi	67%	25%	8%
Bang Khen	64%	25%	11%
Phya Thai	65%	26%	9%
Vadhana	67%	27%	6%
Dusit	54%	27%	18%
Klong San	60%	27%	13%
Din Dang	66%	28%	7%
Bang Sue	51%	28%	21%
Huai Khwang	61%	28%	11%
Yannawa	57%	28%	15%
Sathorn	44%	28%	27%
Ratchathewi	60%	29%	11%
Nong Kheam	55%	30%	15%
Bang Kho Leam	51%	31%	18%
Phra Khanong	53%	32%	15%
Bang Na	49%	33%	18%
Bang Rak	44%	33%	24%
Chatuchak	46%	33%	21%
Bang Plat	43%	34%	23%
Klong Toei	54%	38%	9%
Phra Nakhon	42%	38%	20%
Thon Buri	47%	38%	14%
Samphanthawong	46%	40%	13%
Parthum Wan	36%	42%	22%
Pom Prap Sattru Phai	40%	44%	17%

Source: Author's calculations

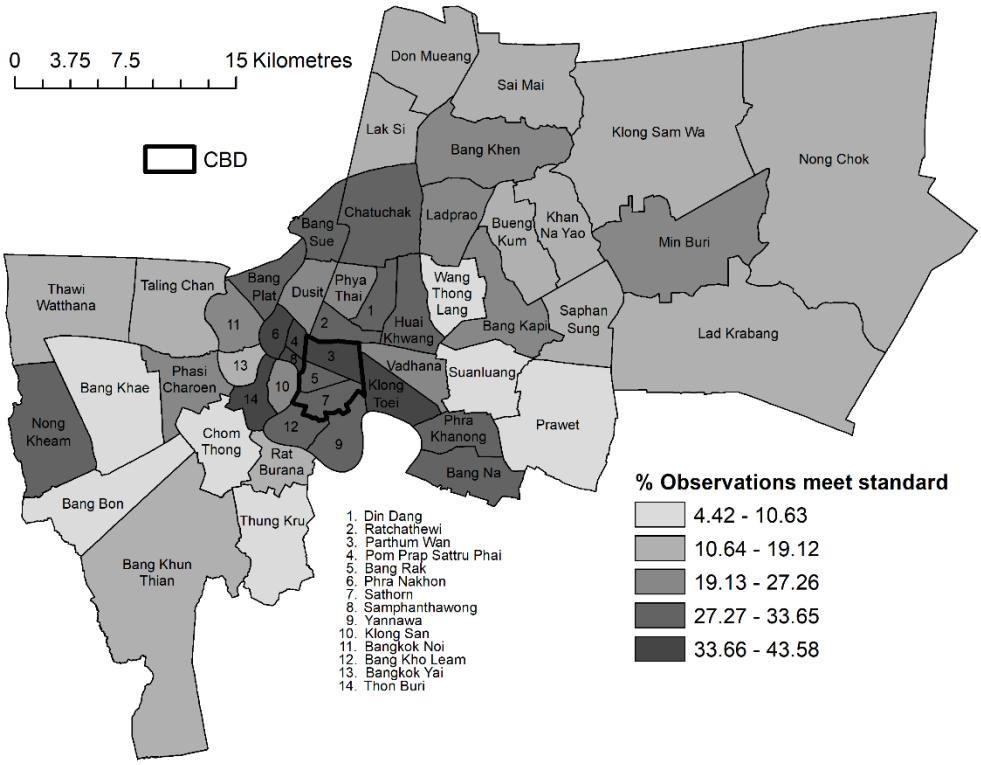

Figure 6.7 Choropleth map of the proportion of A/S ratios meeting IAAO standards in 50 Bangkok boroughs

The COD result suggests that assessment levels in outer Bangkok boroughs are more horizontally equitable than those in inner areas. In other words, similar priced homes in most outer boroughs have been assessed fairer than those in most of the inner boroughs. As shown in Table 6.7, lower COD values are mostly found in outer boroughs rather than inner ones. Distribution patterns of COD throughout Bangkok reveal that areas in which housing is more similar in terms of types tend to have lower COD. Housing in these areas is more affordable and usually occupies greater space. Areas such as Suanluang, Prawet and Bang Khae have been popular destinations for middle-income residents who would rather pay for more space than close proximity to workplaces in the CBD (Figure 6.8).

The results also reveal moderate levels of COD in northern and southern fringes of Bangkok. Transport infrastructure in these areas has been extensively developed during the study period. This includes an extension of the BTS blue line from Bang Sue that runs through Bang Plat, Bangkok Noi and Bangkok Yai, connecting the central transport hub to western boroughs. There is also a new expressway route that runs from Bang Sue through Taling Chan, creating a new bypass ring road that links the centre to

the west side of the city (Realist, 2017). In fact, many locations in these northern fringe areas have been occupied by a vast variety of house types. Some properties have been used for both commercial and residential purposes. This is believed to have caused some difficulties in the assessment process and, therefore, created disparities of assessed prices within the same category of housing types.

The southern fringe of Bangkok has long been a destination for the most various types of land use comprising industrial, commercial and residential. This area has gone through certain levels of gentrification since the late 1990s. Warehouses along the river have been converted to large scale outdoor markets, and many residential zones have been granted licenses for restaurants and shopping malls (RYT9, 2015). This phenomenon has not only significantly affected property values but also changed characteristics of the area. Affected boroughs includes Rat Burana and Yannawa, which have CODs of 38.4 and 33.6 per cent respectively, which are higher than Bangkok's average COD of 30.8 per cent. The COD results suggest that assessments of residential properties in densely and diversely developed areas tend to be more horizontally inequitable than those in areas in which less dense and diverse properties exist.

Interestingly, it would be more understandable if more diverse land uses cause higher vertical but not horizontal inequities. This is partly due to assessment systems that do not clearly differentiate properties according to their types/uses. As person D, an assessor in the West Bangkok assessment division, put it:

> …We draw sale prices from all kinds of properties. Main roads with lots of shophouses are typically defined as commercial use, where smaller alleys are defined as residential use. However, these definitions of commercial/residential uses may not have a direct relationship with the types of sale properties from which the assessed prices are derived. It is more about the feelings of most assessors. If it looks like a busy area then it is commercial use, that's it.

In principle, in order to get close to the market values, properties of different uses should be assessed using different approaches. For example, commercial properties are typically assessed by their revenue generation capacity (income approach) while residential properties are typically assessed by market comparison approach (because, other than rented housings, they do not generate any revenue for owners).

Table 6.7 COD for 50 Bangkok boroughs and proportion meeting IAAO standards

Borough		Proportion within:	
	COD	10% of median	15% of median
Suanluang	18.2%	47.2%	59.3%
Bang Khae	20.3%	36.2%	51.4%
Prawet	20.3%	40.1%	55.8%
Nong Chok	21.6%	40.3%	52.3%
Chom Thong	22.6%	30.1%	46.4%
Nong Kheam	23.1%	29.3%	43.6%
Saphan Sung	23.9%	28.6%	45.2%
Bang Bon	24.0%	27.6%	37.2%
Thung Kru	24.2%	26.6%	39.7%
Thon Buri	24.8%	42.9%	51.9%
Lad Krabang	25.1%	29.4%	40.0%
Thawi Watthana	25.1%	23.7%	34.5%
Min Buri	25.3%	27.2%	37.8%
Pom Prap Sattru Phai	25.9%	44.1%	48.6%
Sai Mai	27.0%	24.8%	38.4%
Klong Sam Wa	27.4%	20.8%	31.9%
Bang Plat	27.5%	34.6%	46.2%
Bang Rak	27.5%	31.0%	41.5%
Bang Khen	27.5%	19.2%	27.8%
Bang Khun Thian	27.6%	25.5%	37.5%
Bang Na	28.0%	28.2%	41.1%
Phasi Charoen	28.2%	19.8%	30.2%
Bang Sue	29.1%	18.8%	34.5%
Bang Kho Leam	29.3%	20.8%	32.3%
Sathorn	29.4%	28.3%	40.4%
Phra Khanong	29.6%	19.9%	35.4%
Parthum Wan	30.0%	40.4%	46.5%
Don Mueang	30.7%	24.6%	39.3%
Huai Khwang	30.7%	15.0%	23.5%
Ladprao	30.9%	17.7%	25.7%
Ratchathewi	31.0%	17.6%	34.1%
Khan Na Yao	31.3%	26.4%	39.0%
Bang Kapi	32.0%	15.7%	25.3%
Din Dang	32.1%	14.7%	23.7%
Samphanthawong	32.9%	33.9%	46.4%
Chatuchak	33.3%	30.1%	39.4%
Yannawa	33.6%	14.1%	20.1%
Klong San	34.2%	21.6%	32.7%
Bueng Kum	34.3%	16.3%	27.2%
Klong Toei	35.0%	13.5%	27.5%
Phra Nakhon	35.1%	33.3%	43.5%
Phya Thai	37.1%	10.4%	18.4%
Rat Burana	38.4%	11.5%	18.3%
Wang Thong Lang	39.0%	10.0%	17.0%
Dusit	41.5%	18.4%	27.2%
Bangkok Noi	42.1%	7.2%	12.3%
Taling Chan	43.3%	13.9%	22.8%
Vadhana	45.7%	9.1%	10.2%
Lak Si	51.5%	8.9%	12.4%
Bangkok Yai	52.7%	19.2%	22.6%

Source: Author's calculations

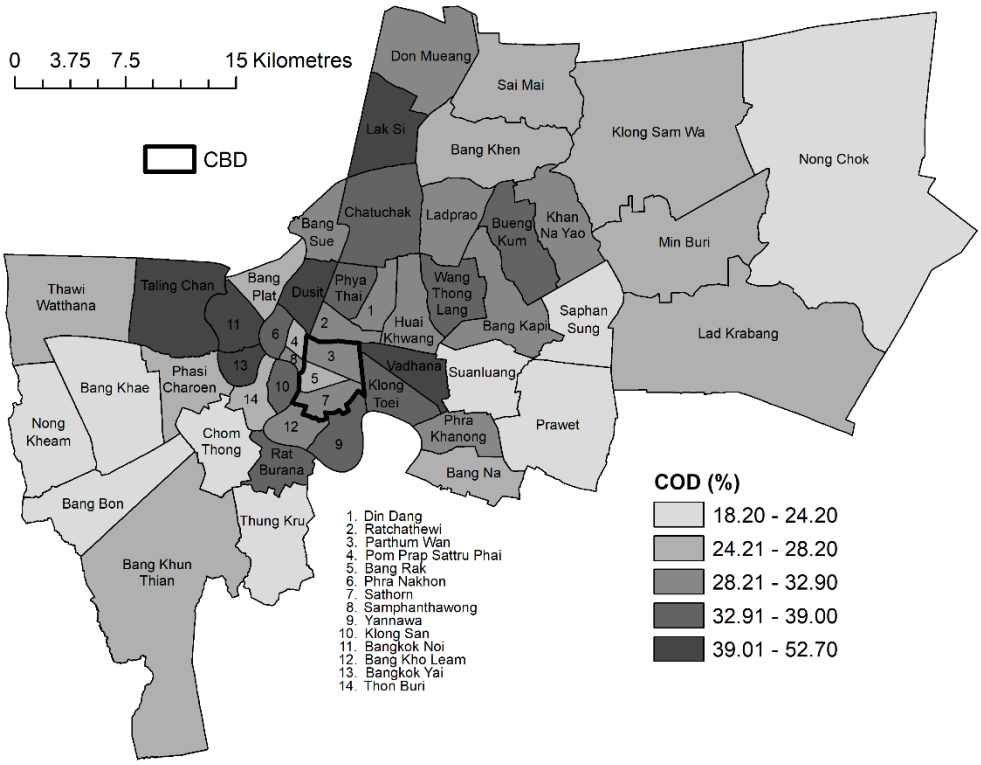

Figure 6.8 Choropleth map of COD in 50 Bangkok boroughs

We will now turn our attention to the PRD index, which is a measure for vertical equity, in which 1 represents perfect vertical equity. As shown in Table 6.8, PRD of all boroughs in Bangkok is ranked from the smallest to the largest values. None of Bangkok's boroughs has met the IAAO's standard PRD index range of 0.98 to 1.03. However, the results have revealed some interesting geographical distribution patterns for PRD throughout Bangkok. It is evident that occupants of lower priced homes are, in general, experiencing disadvantages as PRD indices in all boroughs are higher than one. Vertical inequity is highly concentrated in some downtown and inner suburban boroughs. As shown in Figure 6.9, the geographical distribution of PRD confirms that the problem of inconsistency in assessed prices is caused by the assessment method, namely that, particularly in the CBD, residential properties have been assessed using the same approach as commercial ones. This has caused the most serious disadvantages for low priced housing in the following central boroughs: Parthum Wan, Vadhana, Klong Toei and Sathorn.

It is also immediately clear from the spatial distribution shown in Figure 6.9 that moderately high levels of PRD are concentrated in eastern suburbia. With PRD ranges

between 1.174 and 1.180, these eastern boroughs—including Ladprao, Bueng Kum, Khan Na Yao, Wang Thong Lang, Bang Kapi and Huai Khwang—stand out from their surroundings. The results can be explained by the fact that properties in these boroughs have been assessed by the same team of assessors (East Bangkok division). Given relatively diverse types of housing in these areas, errors in assessment seem to be repeated, which causes specific assessment error patterns within certain price ranges (BMA, 2013). Once these errors happen, they have been upheld by assesment practices that focus on continuity of assessed values in all areas rather than on closing the gap between assessed and market prices.

Table 6.8 PRD for 50 Bangkok boroughs

Borough	PRD
Chom Thong	1.045
Nong Chok	1.045
Bang Bon	1.056
Bang Khae	1.063
Suanluang	1.071
Thon Buri	1.073
Prawet	1.077
Bang Plat	1.079
Thung Kru	1.082
Lad Krabang	1.092
Nong Kheam	1.096
Saphan Sung	1.098
Bang Khun Thian	1.106
Min Buri	1.111
Sai Mai	1.114
Bang Khen	1.123
Chatuchak	1.124
Don Mueang	1.127
Klong Sam Wa	1.128
Din Dang	1.135
Thawi Watthana	1.142
Rat Burana	1.149
Phra Khanong	1.154
Bang Sue	1.163
Dusit	1.173
Ladprao	1.174
Bueng Kum	1.180
Phasi Charoen	1.183
Khan Na Yao	1.191
Wang Thong Lang	1.192
Bang Kapi	1.199
Yannawa	1.208
Bang Na	1.235
Huai Khwang	1.261
Bang Kho Leam	1.266
Bangkok Yai	1.274
Taling Chan	1.283
Lak Si	1.306
Bangkok Noi	1.336
Ratchathewi	1.345
Klong San	1.364
Pom Prap Sattru Phai	1.383
Phra Nakhon	1.384
Phya Thai	1.472
Samphanthawong	1.564
Sathorn	1.676
Bang Rak	1.685
Klong Toei	1.895
Vadhana	2.016
Parthum Wan	2.573

Source: Author's calculations

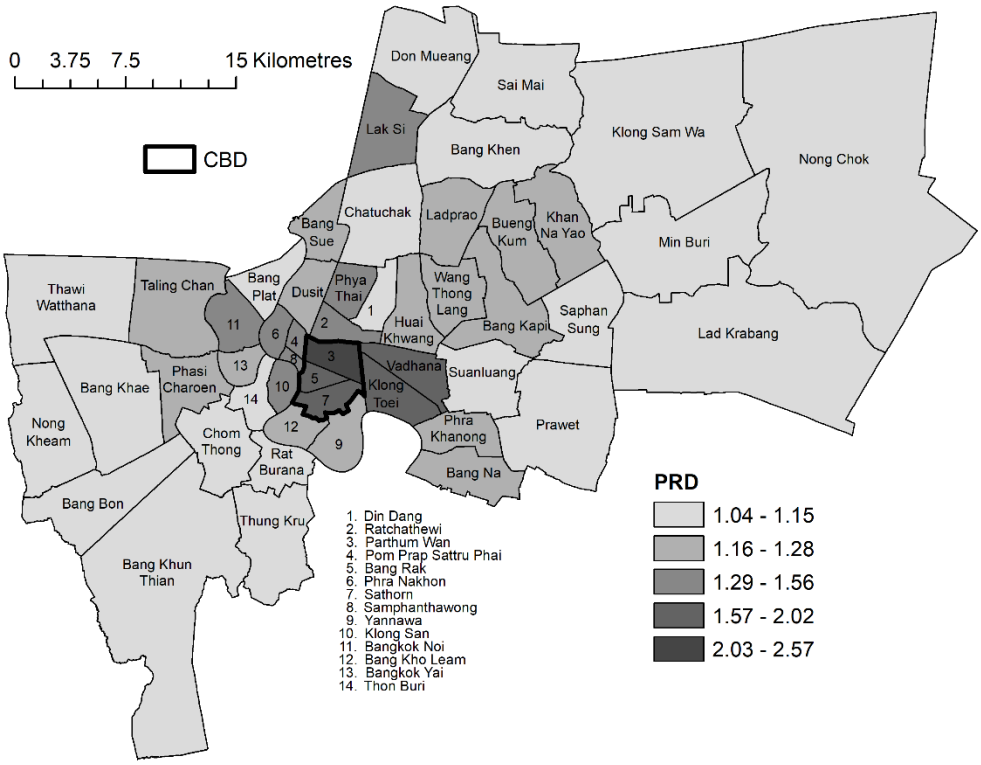

Figure 6.9 Choropleth map of PRD in 50 Bangkok boroughs

In fact, a similar conclusion to the COD analysis can be drawn from the PRD results. Given an average PRD level for Bangkok of 1.27, most boroughs with higher-than-average PRD levels are areas where dense property developments exist. If we reconsider the assessment approach adopted by the PVB, in which street values are assigned according to the majority property type on each street, properties can not be precisely assessed by such a crude differentiation technique. In areas where properties of various values and types are located, it is even harder for a single assessed price to capture sufficient market forces that translate into transaction prices. Therefore, these areas are prone to more assessment errors and wider gaps between assessed and sale prices than other areas with less property density.

The analytical methods that we have employed in this section have produced some useful results that allow us to compare A/S ratios among boroughs, but the association between assessed and sale prices are difficult to judge from the descriptive statistics and choropleth maps. It is still impossible to identify, for instance, the tendency of some groups of properties within certain value ranges to show systemic assessment biases, especially those that are location related. Therefore, it is necessary to investigate

spatial inequities at a more detailed areal unit. In the following section, a more detailed examination of A/S ratios will be carried out using local Moran's analysis.

6.3 Spatial Autocorrelation Analysis

The non-spatial empirical results laid out in the previous section suggest that there are disparities in property assessments in certain areas of Bangkok. The most noticeable pattern is the presence of higher A/S ratios and a higher degree of both horizontal and vertical inequity in inner city areas. Also, there are disparities in the level of assessments between certain suburban and central boroughs. However, the results do not specify neighbourhoods or housing submarkets that may have been inaccurately assessed. In this regard, spatial autocorrelation analysis is useful for determining assessment errors at more detailed areal units—i.e. street level, which may better help identify potential causes of the problems.

A preliminary global spatial autocorrelation analysis of A/S ratios gives the p-value of zero, which indicates that we can reject the null hypothesis. The z-score of 25.77, and the Moran's index of 0.29, indicate a relatively strong spatial autocorrelation, with less than one per cent likelihood that this clustered pattern could be the result of random chance. The results, however, do not distinguish whether clustered patterns are dominated by concentrations of high or low values. In the following section we will move on to local Moran's analysis of A/S ratios throughout the study area to identify specific locations of these clusters.

6.3.1 Univariate Local Moran's I: A/S Ratio

In this section we move the analysis from borough to property levels. It can be seen from the ratio analysis that both horizontal and vertical inequities exist and that they vary by geographical areas. However, the approach does not clearly identify the extent to which the problem occurs at specific locations. Local Moran's analysis can identify clusters and outliers of A/S ratios at smaller geographial scales. An A/S ratio for each property is compared to that of its surrounding properties through weight matrix. A z-score is an indicator for clusters and outliers. In this study, it is assumed that a positive z-score of two or greater indicates that the data point is similar to its neighbours, and a negative z-score of two or greater indicates that the data point is dissimilar from its neighbours.

When locations of clusters and outliers of A/S ratios are identified, they can directly reflect the spatial distribution patterns of assessment levels as defined by the street

values, which are the core of the assessment processes. Assessors derive street values from a number of sales located on the same street (or a group of similar streets) using market comparison approach. The street value is the average of these sale prices in relation to the values of properties located on other streets nearby (PVB, 2009). Clusters of A/S ratios can be interpreted as groups of uniformly but inaccurately assessed properties, and outliers of A/S ratios can be interpreted as neighbourhoods with dissimilarities in either assessed or sale prices (or both) that seem to have certain kind of assessment bias. My hypothesis is that A/S ratio clusters tend to be street-specific and can be directly related to systemic bias in assessment practices, while outliers tend to relate to occasional errors that are not systemic.

The results of univariate local Moran's statistic for the A/S ratio are presented in Figure 6.10—it would be helpful to read the results in relation to the level of urban developments exhibited in Figure 6.11. The figure shows the results in four areal units: borough, sub-district, 1-kilometre grid and 500-metre grid (see Table 6.9 for details). In general, the results suggest that clusters and outliers are largely concentrated in the suburban areas in both eastern and western parts of Bangkok. All types of clusters and outliers are crucial for the identification of assessment problem types. While the results from all areal units exhibit the same tendency in general, maps presented at smaller areal units (Figure 6.10 c-d) reveal more clusters and outliers in outer suburban areas in both sides of the city.

A cluster of high-high A/S ratio indicates a concentration of relatively over-assessed properties, and a low-low cluster indicates the concentration of relatively under-assessed properties. These two types of clusters imply that either the properties in these areas have been continually mis-assessed over the period of three assessment cycles or that they are disproportionately affected during housing booms. The existence of these two types of cluster can in fact be interpreted as indicating systemic assessment errors. The results of this study are in fact contrary to those of Heavey (1983), who found that properties in the core CBD tend to be over-assessed relative to those in peripheral areas. But the local Moran's results in Bangkok indicate that properties in suburban areas tend to be assessed higher than those in the city centre. In this case, however, it is not totally appropriate to interpret clusters of high-high A/S ratios as concentrations of over-assessed properties as the ratio analysis results show

otherwise. A low-low cluster, on the other hand, can be interpreted as concentrations of under-assessed properties as the evidence suggests.

A high-low outlier indicates that relatively over-assessed properties are surrounded by under-assessed properties, and a low-high outlier indicates that under-assessed properties are surrounded by relatively over-assessed properties. These two types of outlier particularly indicate potential assessment errors as they demonstrate inconsistencies in assessment standards as well as inaccucary of the assessed prices. It is possible that the outliers are the result of the difference in the assessed prices of two or more groups of properties located on different streets. These observations will be confirmed by street-level analysis in the following section.

More high-low outliers are found in the eastern, northeastern and western parts of Bangkok. Especially in the northeast, high-low outliers are often accompanied by high-high clusters. Low-high outliers seem to be relatively scattered and they appear in the east more than the west. Unlike high-low outliers and high-high clusters, the low-high outliers are mostly located in large gated communities or isolated housing developments rather than in mixed-use areas along the main roads and urban rail transport lines (PVB, 2016b, 2019). In fact, this sort of irregularity of under-assessed properties surrounded by over-assessed properties is likely to have been caused by high market values of high-end housing in the suburbs. While it is not conclusive that outliers have been caused by the assessment practices, they can, to some extent, confirm the existence of spatial inequities of assessed prices.

Table 6.9 Descriptions of areal units

Areal unit	Number of unit	Area (km^2)	
		Mean	SD
Borough	50	31.66	41.05
Sub district	169	9.37	11.36
1-km grid	2,345	1.00	0.01
500-m grid	7,841	0.25	0.00

Source: Adapted from Shiode et al. (2014)

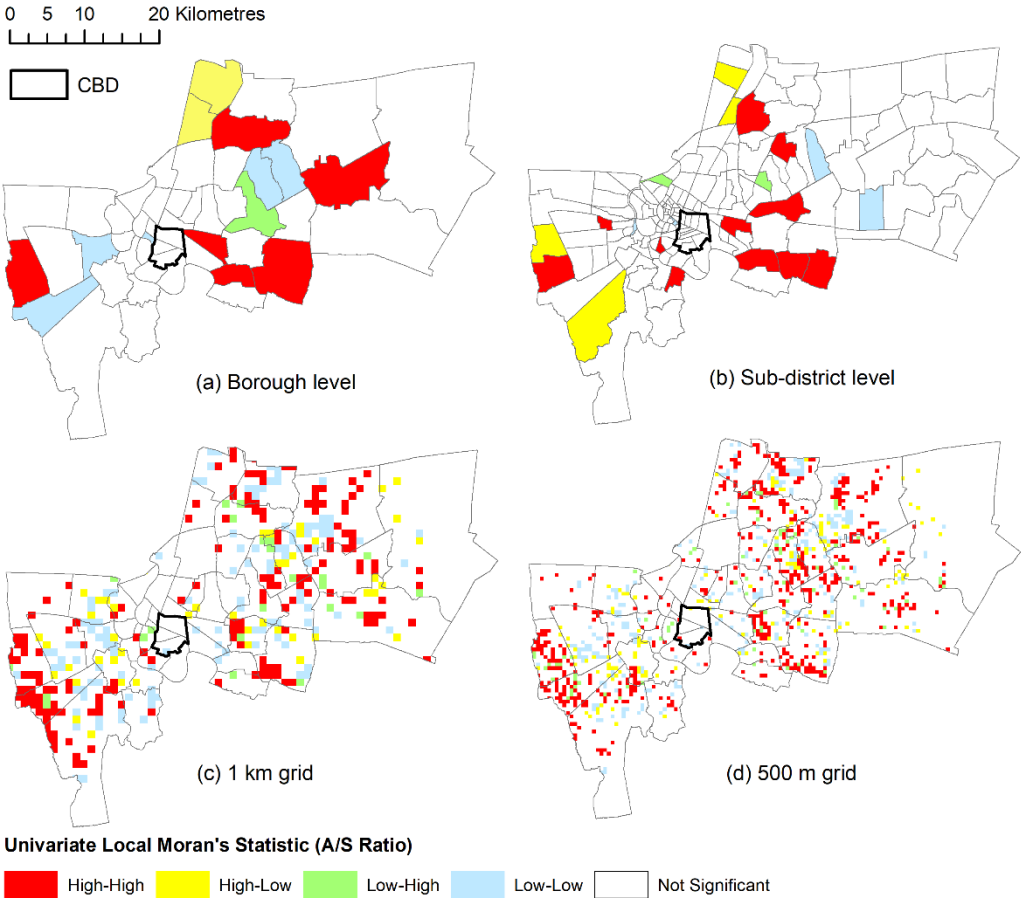

Figure 6.10 Spatial distribution of clusters and outliers of A/S ratios in Bangkok

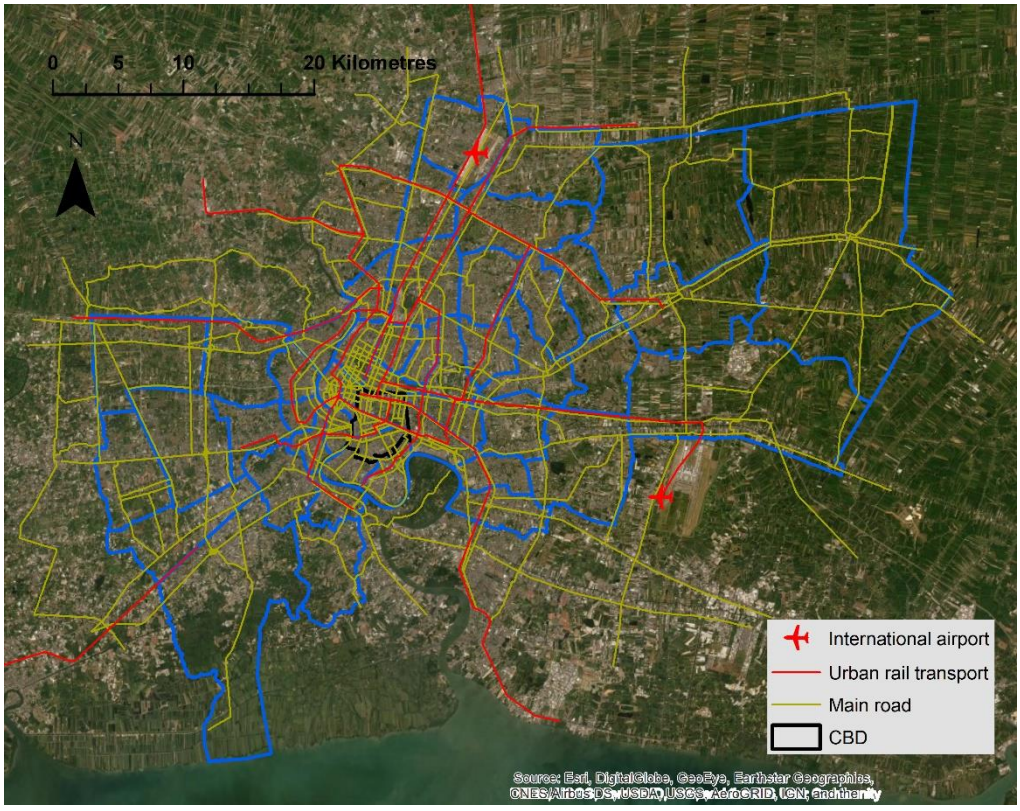

Figure 6.11 Basemap of Bangkok

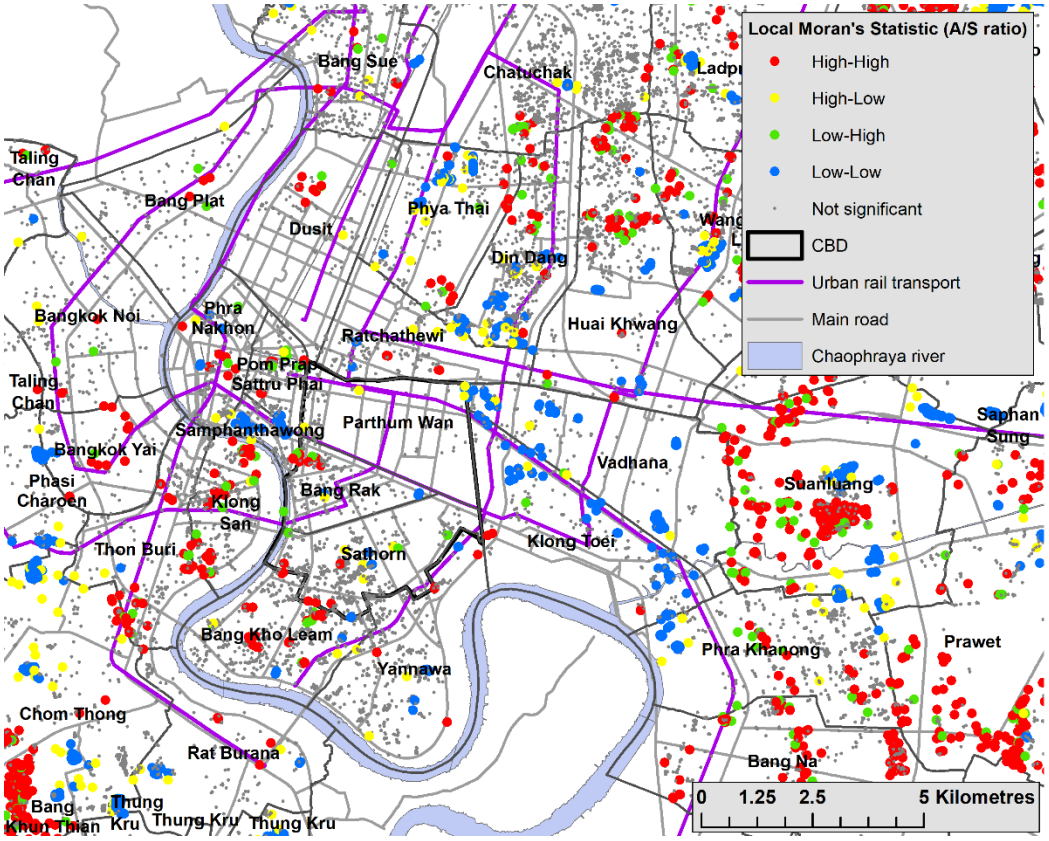

Figure 6.12 Distribution of clusters and outliers of A/S ratios in inner Bangkok

As shown in Figure 6.12, the distribution of A/S ratios in inner Bangkok including the CBD seems to be fairly uniform. There are relatively small numbers of either clusters or outliers of A/S ratios in most inner boroughs. A few concentrations of low-low clusters are found in Bangkok old town, particularly on Yaowarat Road (Chinatown), and in new commercial districts such as Parthum Wan, Vadhana, Klong Toei and Ratchathewi. Most developments in these areas are old shophouses that are mainly used for commercial purposes. Only a few properties have residential units on the higher floors. Most residential properties in the areas are located in small alleys (PVB, 2016b). In the CBD, there are very few outliers of either types. High-low outliers are found in small alleys rather than in main roads, but no concentration can be detected.

In the eastern suburbs, there are more concentrations of high-low and low-high outliers, mostly located in gated residential communities (Figure 6.13). The concentrations of high A/S ratios are found along similar road/alley networks. This is presumably because assessment errors as the spatial pattern of concentration is consistent with the assessment practices that employ street value approach—providing a single assessment for the same street regardless of land use composition or individual

housing characteristics. The concentrations of low-high outliers are, however, slightly different as they are, in general, located along main roads. There is also a higher number of high-high clusters, which attests to a larger continuous area as compared with the concentrations of outliers. Clusters of low-low A/S ratios, on the other hand, tend to mingle with groups of outliers in most locations.

Similar spatial distribution patterns are found in western suburban areas, but the concentration of high-low outliers is less scattered and mostly located along main roads and urban rail transport lines, as is the concentration of low-low clusters (Figure 6.14). However, the spatial distribution pattern of low-high outliers and high-high clusters largely emerges in residential communities of similar housing characteristics. In Nong Kheam, for example, most of the low-high outliers are located in high-end gated communities. In Bang Khun Thian, however, the low-high outliers seem to be spread along secondary and tertiary road networks.

The results in west Bangkok suggest that property assessment inconsistencies tend to occur in the areas where recent significant adjustments of assessed prices have been made. In Thawi Watthana and Taling Chan, for instance, there are less occurrences of clusters and outliers because assessed prices during the past two cycles have been fairly stable. These areas saw a marked increase in assessed prices during the reassessment in 2012. On the contrary, in Nong Kham, Bang Bon and Bang Khun Thian, there was a relatively large increase in assessed prices during the last reassessment in 2016, which resulted in a higher degree of assessment inconsistencies.

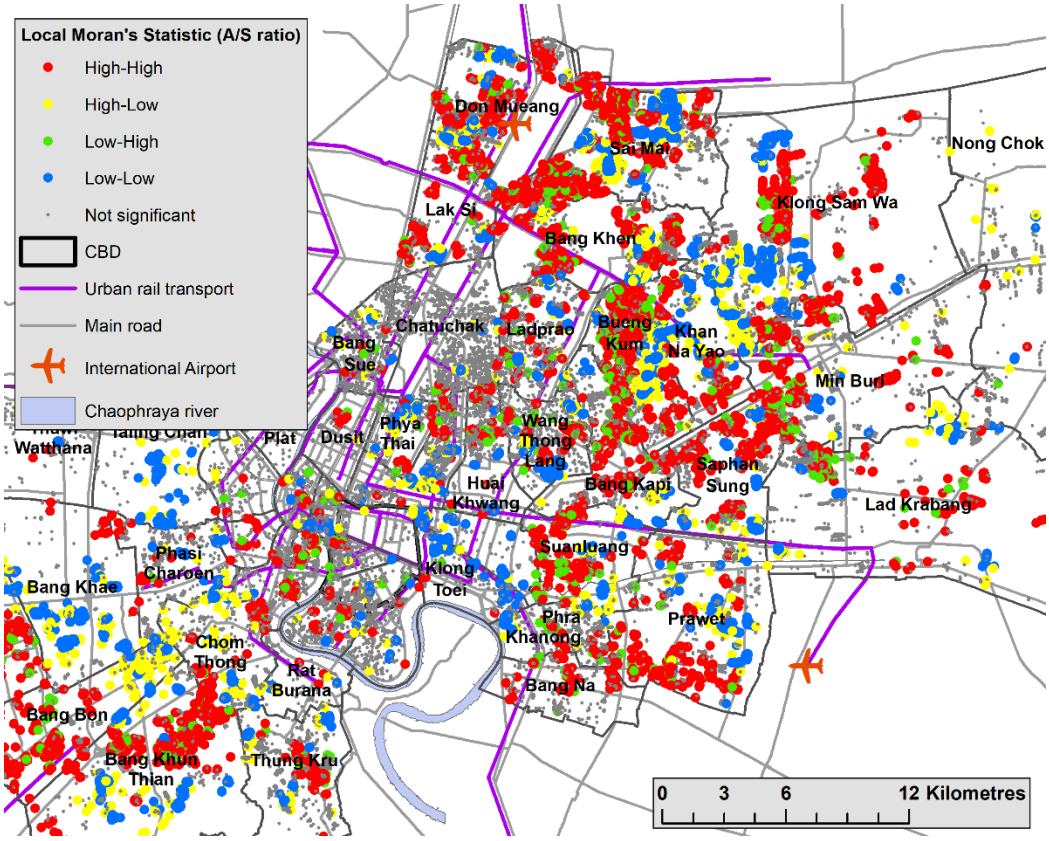

Figure 6.13 Distribution of clusters and outliers of A/S ratios in East Bangkok

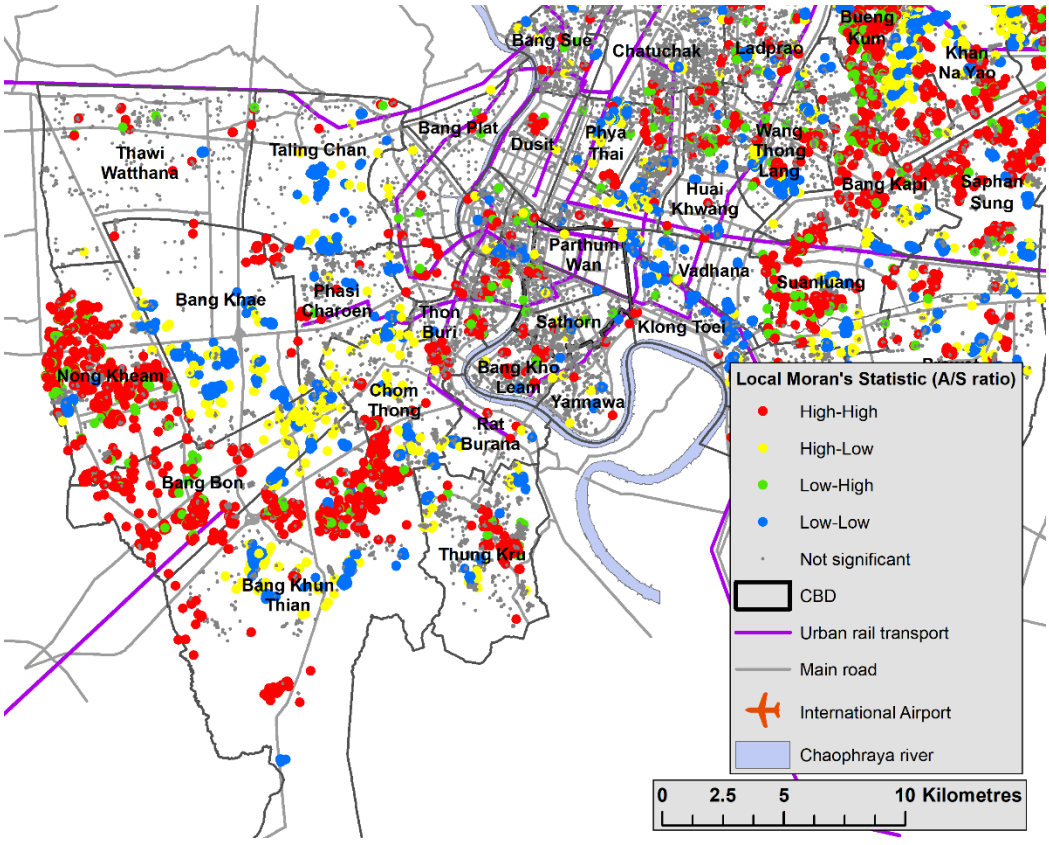

Figure 6.14 Distribution of clusters and outliers of A/S ratios in West Bangkok

6.4 Regression Analysis

6.4.1 Diagnostic Tests

The regression analysis begins with the OLS modelling to determine appropriate independent variables and to examine whether the spatial distribution of the standardised residuals is random or not. The global Moran's I is used to test if the residuals are spatially autocorrelated. Given the z-score of 0.074 and the Moran's index of 0.052, it is confirmed that there is no cluster of the distribution of standardised residuals (see Figure 6.15). All parameters at the global scale have intuitive sign and are statistically significant (Table 6.10).

In the first OLS model (A), the dependent variable is the assessed price, and there are four explanatory variables that play an important role in the assessment process. The distance to urban rail transport station and the distance to main road variables have been omitted from the first model to see how these variables perform under the assumption that the effects of urban rail transport have already been accounted for in the transaction price.

The Koenker test gives a significant p-value, which is reflective of the fact that the relationships between variables in the model are nonstationary across the study area. Therefore, we refer to the robust probabilities to determine if the explanatory variables are statistically significant. In terms of model redundancy, none of the variables exhibits high VIF values, which indicates no multicollinearity problem.

The results reveal that the building area variable has the greatest effect on assessed price, followed by the land area and building age variables. However, it is surprising that transaction price has the least influence on assessed price. This is contrary to our hypothesis that sale price is a key determinant of assessed price, given that the market assessment approach directly derives assessed value from sale data.

Table 6.10 OLS model estimation results (model A)

Variable	Coefficients	Robust S.E.	Robust-t	Robust-p	VIF
Property age	5.3235	1.2586	4.2295	0.0000	1.0034
Building area	13.8306	3.4383	4.0224	0.0000	1.5329
Land area	-7.7235	1.8828	-4.1021	0.0000	1.4314
Transaction price	0.2991	0.0301	9.9086	0.0000	1.1414
Number of observations	3,673				
R^2	0.5836				
Adjusted R^2	0.5831				
AIC	75,442.30				

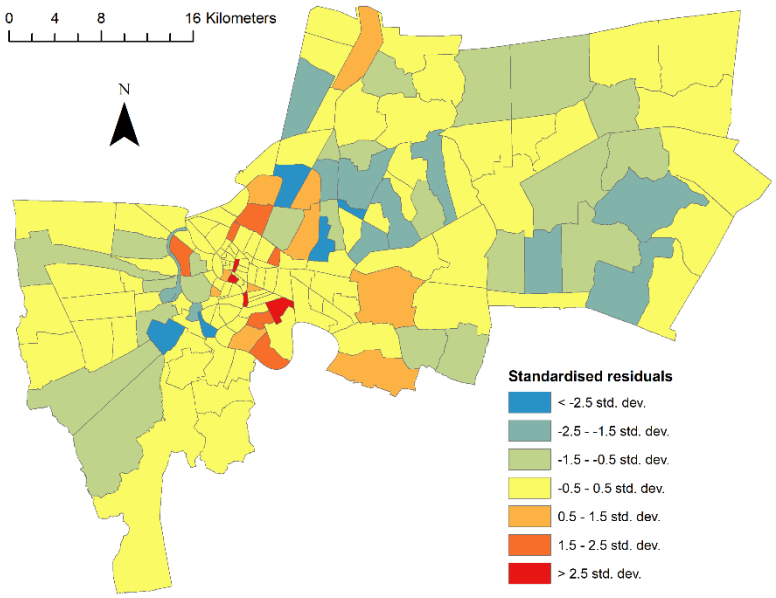

Figure 6.15 Distribution of standardised residuals in the OLS model A

The second OLS model (B) has included two additional variables: distance to rail station (distance between each property and the nearest urban rail transport station) and distance to main road (distance between each property and the nearest access point to the nearest main road). A test for spatial autocorrelation of the standardised residuals indicates a negative result as it gives the z-score of 0.077 and the Moran's index of 0.055. The model estimation is shown in Table 6.11 and the spatial distribution of standardised residuals is presented in Figure 6.16. The OLS model B is also tested statistically significant for Koenker p-value, we therefore consult robust p-values for statistical significance of the variables. The VIFs in this model show acceptable correlation between the variables.

Interestingly, the two additional variables have improved the model as the AIC value of model B is lower than that of model A, and the adjusted R-squared value in model B is slightly higher than that of model A. When considering the relationship between variables, it appears that building area remains the most influential variable, followed by land area and building age. However, it should be noted that the distance to main road and rail station variables have a greater impact on the overall assessed price than the transaction price variable has, which implies that proximity to public infrastructure may not have been fully reflected in sale price. In addition, variations in assessed prices are more likely to be influenced by building types and their areas rather

than changes in sale prices. Again, this contradicts our hypothesis on the PVB assessment practices, which derive assessed price directly from sale price, and give more weight to sale data than building costs/ages.

Table 6.11 OLS model estimation results (model B)

Variable	Coefficients	Robust S.E.	Robust-t	Robust-p	VIF
Property age	3.9808	1.1335	3.5119	0.0004	1.0112
Building area	12.9615	3.2331	4.0089	0.0000	1.5362
Land area	-7.2039	1.7817	-4.0432	0.0000	1.4349
Transaction price	0.2847	0.0294	9.6699	0.0000	1.1894
Distance to rail station	-0.5974	0.0549	-10.8656	0.0000	1.1280
Distance to main road	-1.5600	0.1477	-10.5583	0.0000	1.1032
Number of observations	3,673				
R^2	0.6080				
Adjusted R^2	0.6074				
AIC	75,224.02				

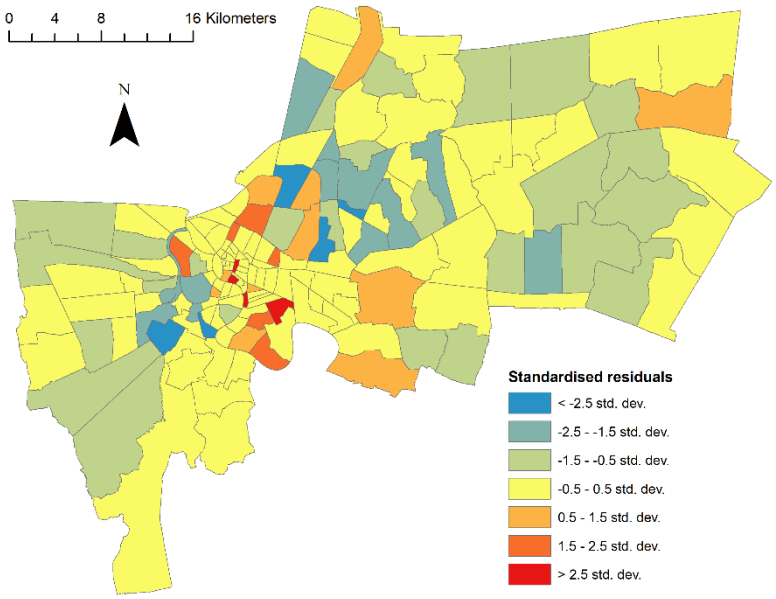

Figure 6.16 Distribution of standardised residuals in the OLS model B

In the first two OLS models, we did not consider the density aspect. The data allows us to examine three types of density: property density (all types), housing sale density and population density. A preliminary variable analysis shows strong positive correlations between property density and population density and between property density and property sale density. This suggests that property sale density and population density are represented by property density. Therefore, only the property density variable is added to OLS model C (Table 6.12). Global Moran's analysis confirms that spatial autocorrelation of the model's standardised residuals does not exist, with the z-score of 0.071 and Moran's index of 0.051. The spatial distribution of the standardised residuals is shown in Figure 6.17.

The additional variable improves the overall performance of the model, as evident in the higher R-squared value and lower AIC value than seen with OLS models A and B. One overall relationship does not markedly change: building area remains by far the most influential variable in the model, followed by land area, which still has a significant negative effect on assessed price. This means that larger houses—in terms of total area—tend to be assessed lower than smaller houses. The question is whether larger property area reflects higher property wealth or not. A linear correlation analysis between land parcel area and sale price gives a coefficient value of -0.024, which indicates a mild negative relationship between the two variables.

Table 6.12 OLS model estimation results (model C)

Variable	Coefficients	Robust S.E.	Robust-t	Robust-p	VIF
Property age	3.4578	1.1962	2.8905	0.0038	1.0141
Building area	12.6679	3.1659	4.0013	0.0000	1.5372
Land area	-7.2918	1.7822	-4.0913	0.0000	1.4351
Transaction price	0.2779	0.0295	9.3922	0.0000	1.2158
Distance to rail station	-0.3034	0.0685	-4.4290	0.0000	1.4237
Distance to main road	-1.3838	0.3608	-9.8672	0.0000	1.1141
Property density	1.8641	0.1402	5.1653	0.0000	1.4207
Number of observations	3,673				
R^2	0.6178				
Adjusted R^2	0.6171				
AIC	75,132.97				

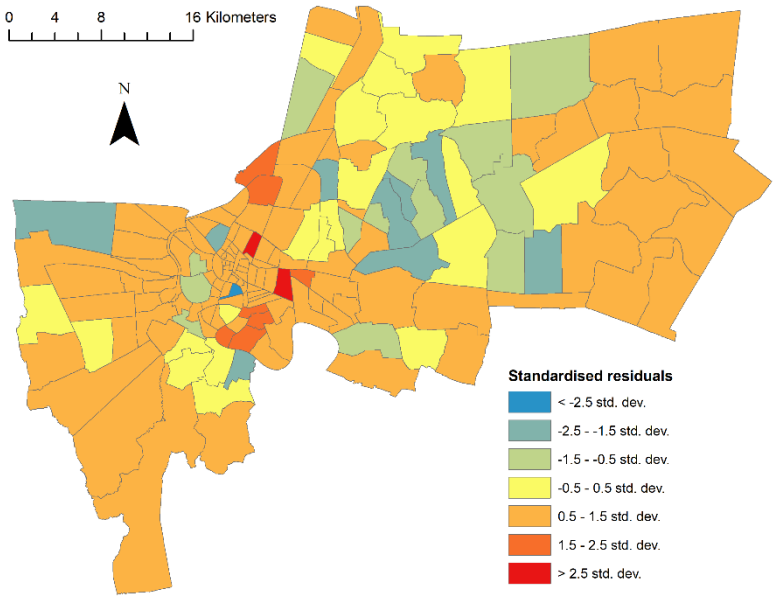

Figure 6.17 Distribution of standardised residuals in the OLS model C

6.4.2 GWR Models

The GWR modelling gives local parameter estimates for each observation point. The GWR model has better goodness of fit compared to that of the OLS models, which is confirmed by lower AIC value and significantly higher adjusted R-squared value in the GWR model. The fact that the GWR outperforms the OLS model indicates that the nonstationary effects play an important role in providing better fit for the GWR model. In general, the GWR results are different, and perhaps more precise, than those of the OLS, as they demonstrate more consistent coefficient values.

The results of the GWR model shown in Table 6.13 indicate that property age has the most effect on assessed price. It has a significant negative effect on assessed price, possibly because of the PVB's assessment method, which accounts for depreciation rates of improvements. Building area is the second most influential parameter, followed by land area and distance to main road. The land area parameter still has a negative impact on assessed price, which also confirms the tendency of assessments to significantly reduce as land parcel depth increases—part of the PVB's assessment methods (PVB, 2009). As the distance to main road parameter has a greater impact on assessed price than the distance to rail station, it is assumed that the effect of proximity to urban rail transport stations has been reflected in sale price.

Table 6.13 GWR model estimation results (model A)

Variable	Coefficients			
	Mean	Min	Max	SD
Property age	-49.3781	-329.4150	309.6633	63.6920
Building area	26.8435	-6.8541	68.2327	14.2190
Land area	-14.3411	-54.1337	8.5714	8.0514
Transaction price	0.2114	0.0453	0.4188	0.0668
Distance to rail station	0.0109	-11.9694	15.3819	1.9674
Distance to main road	-2.3714	-55.8678	4.1852	6.5372
Number of observations	3,673			
R^2	0.7855			
Adjusted R^2	0.7636			
AIC	73,563.96			

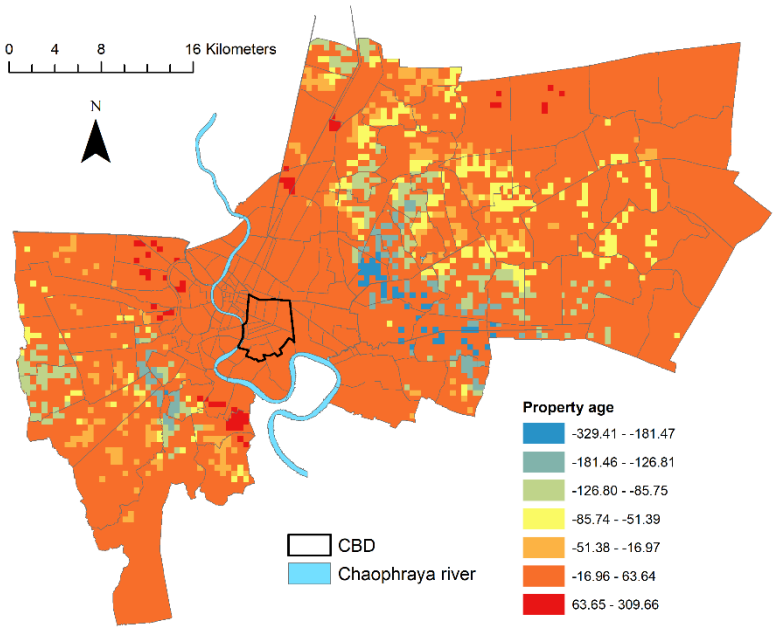

Figure 6.18 Distribution of the property age parameter (GWR model A)

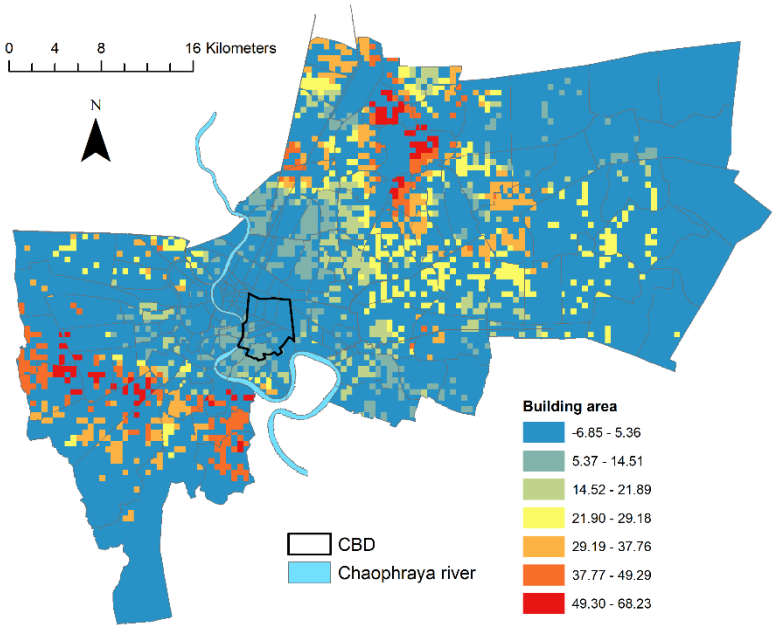

Figure 6.19 Distribution of the building area parameter (GWR model A)

Figure 6.18 shows the distribution of the parameter estimates associated with property age—the number of years accounted for in building depreciation factor. It is evident that, on average, assessed prices of properties in suburban areas are sensitive to building age, especially in the eastern boroughs of Prawet, Wang Thong Lang and Bang Kapi. An average range of property age coefficient values applies largely in outer eastern suburbs, such as the boroughs of Lad Prao, Bang Khen, Bueng Kum and Khan Na Yao. As a result of economic boom, these boroughs were target areas for residential developments between the early 1980s and the late 1990s, during which Bangkok had not seen much residential development in other areas except in the city centre (BMA, 1977, 1992). Therefore, housing in these areas tends to be relatively old compared with more recent residential developments in outer suburbs. The depreciation factors employed by the PVB allow for a substantial deduction of depreciated replacement costs from total assessed values, especially for buildings ten years of age or more.

A similar spatial distribution pattern of the property age coefficient values is found in western suburbs, but the degree of impact is lower. In inner city areas, however, the effect of property age is not significant because low-rise housing has been increasingly converted to either commercial use or condominium, which create more locational values and drive housing price inflation. The effect of property age subsides as it accounts for a smaller proportion of total assessed value, which has increased with the market price.

The building area and land area parameter estimates have similar spatial distribution patterns (Figures 6.19 and 6.20). More significant coefficient values are found in suburban areas on both sides of the city. In fact, the results of all three variables relating to property characteristics exhibit the same tendency of spatial distribution pattern for coefficient values. However, two marked disparities are witnessed in the results. First, in general, the building area variable has a positive impact on the assessed price, while the impact of the land area variable is negative. As the affected areas are largely suburban, it is possible that more variations in residential property types and characteristics have caused greater changes in assessed values. Second, the results reveal a greater impact of the land area variable in certain inner Bangkok areas, starting from the eastern river bank located just west of the CBD up to the heritage areas of Phra Nakorn and Pom Prap Sattru Phai boroughs. Boroughs in north Bangkok (Don Mueang and Sai Mai) are also sensitive to variations in these three variables.

The sale price variable has random effects on assessed prices throughout Bangkok (see Figure 6.21). The spatial distribution pattern of the transaction price parameter indicates that, overall, property assessed prices in seven clusters have been most affected by sale prices. The areas where these clusters are located have either been recently regenerated or benefited from an expansion of urban rail transport lines (BMA, 2009). Furthermore, the result is also consistent with an increase in A/S ratios in the areas, which indicates a growth in assessed prices during the last two assessment cycles. The assessment practice, which tends to average out the assessed value, has suppressed an increase in assessed price in the core urban centre and inner suburbs. Assessors do not favour assessed price disparities and have tried to close the price gap.

Another interesting finding is that assessed prices in areas where urban rail network hubs are located, e.g. Huai Khwang and Chatuchak, appear to be less sensitive to sale prices. This is surprising, given that these areas have been transformed from traditional residential areas to commercial and densely populated mixed-use zones (TerraBKK, 2017). During the past decade, assessed prices in these areas seem to have already caught up with sale prices (PVB, 2012, 2016b). From a mass appraisal point of view, the results reflect good progress in the adjustment of assessed prices. However, the findings also suggest certain inconsistencies in the assessment process, as we can see that clusters of sale price insensitivity are unevenly distributed throughout areas containing a majority of properties that fail to meet the IAAO standards on assessment level. Ideally, the effects of sale price on property assessments should be distributed more evenly across space.

The estimation results for the distance to urban rail stations parameter indicate that assessed prices for properties in most of the urban rail transport catchment areas are sensitive to this parameter except in some suburban boroughs in the east (Figure 6.22). In general, locations of properties with assessed prices that are sensitive to the distance to urban rail transport station variable are consistent with the geographical distribution pattern of stations. The effects are most pronounced in areas where extension lines of urban rail transport have recently been completed, which are located in the boroughs of Bang Plat and Dusit. Evidence also suggests that seven—out of thirteen—urban rail transport lines are particularly influential in the model. Four of the seven lines are located in east Bangkok (the dark red, dark green, pink and grey lines) and the other three are in the west (the light red, blue and purple lines). However, the results for

central Bangkok (on both sides of the river including part of the CBD) reveal clusters of positive parameter coefficient values, which means that assessed prices tend to decrease the closer properties are to urban rail transport stations.

The final variable in the model is an estimate of the impact of proximity to main road on assessed price. As shown in Figure 6.23, overall results exhibit the same spatial distribution pattern between main road layout and the impact of the distance between properties and the nearest main road on assessed prices. The effects of proximity to main roads have generally overcome those of proximity to urban rail transport stations in central and some inner suburban areas. The largest coefficient value range is found in the area where road developments are most concentrated. Given the fact that central Bangkok was the first BTS catchment area (since 1999), it appears that assessed values tend to reduce proportionately more with an increase in distance from main roads, particularly in areas where urban rail transport lines are older.

The results also suggest that the effects of the distance to main road variable are less pronounced in outer suburban areas, especially in eastern and northern boroughs—i.e. Suanluang, Phra Khanong, Saphan Sung, Lad Krabang, Bueng Kum and Sai Mai. Several clusters of positive parameter estimates are found in these boroughs, which indicate that assessed prices tend to increase as properties are located farther from main roads. An increase in distance from main roads is considered a desirable characteristic of residential properties, presumably due to less traffic noise and pollution. Moreover, to a certain extent, the clusters of positive parameter estimates are likely caused by groups of gated residential communities in which some facilities (e.g. security, parks and recreational complex) are separated from those of the outside world.

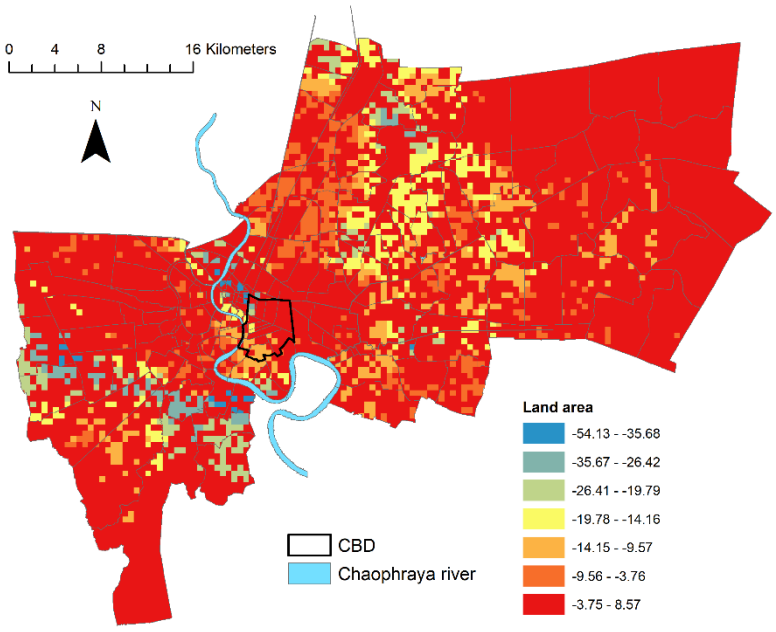

Figure 6.20 Distribution of the land area parameter (GWR model A)

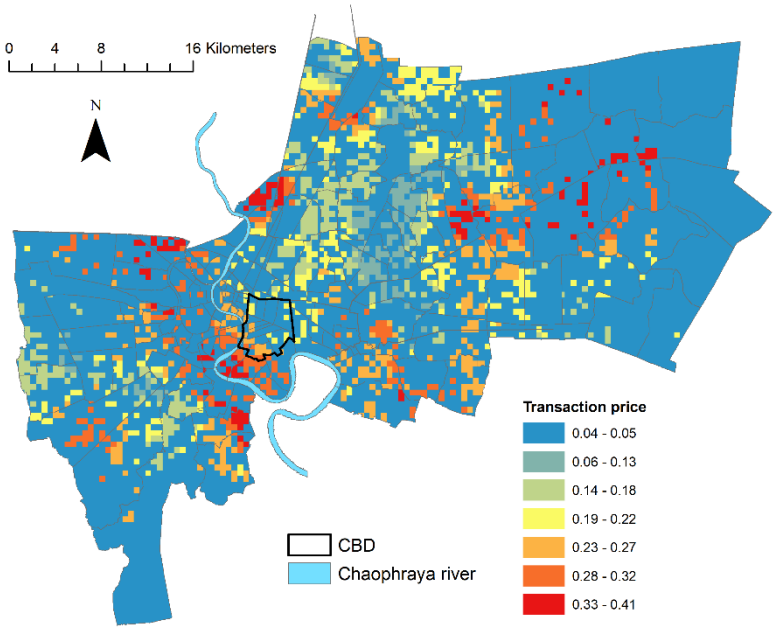

Figure 6.21 Distribution of the transaction price parameter (GWR model A)

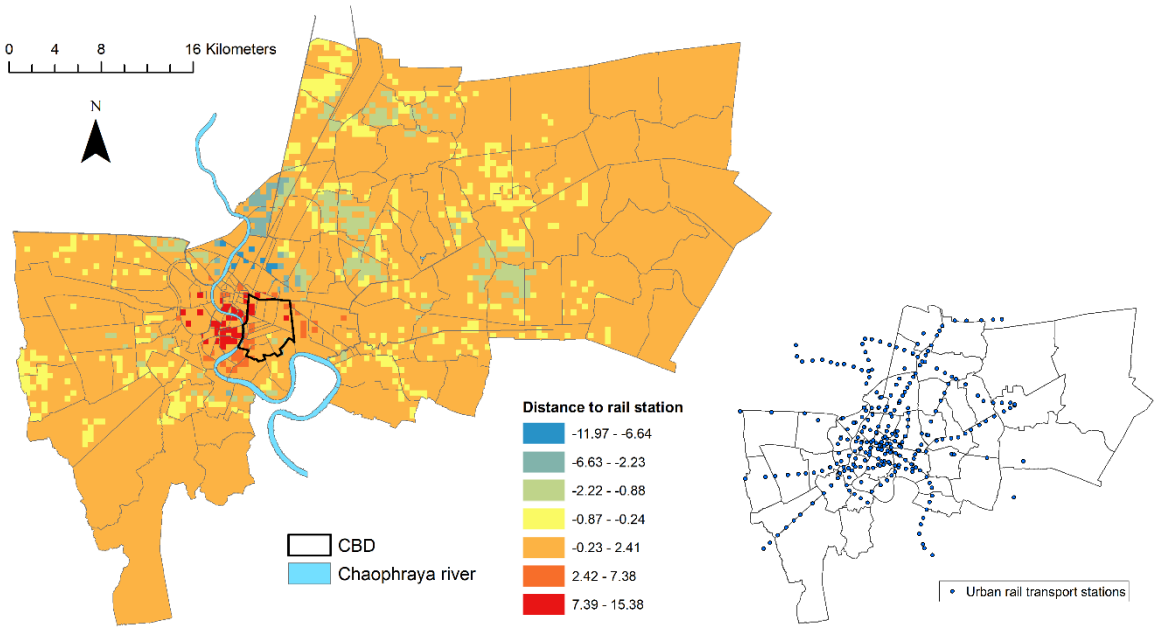

Figure 6.22 Distribution of the distance to rail station parameter (GWR model A)

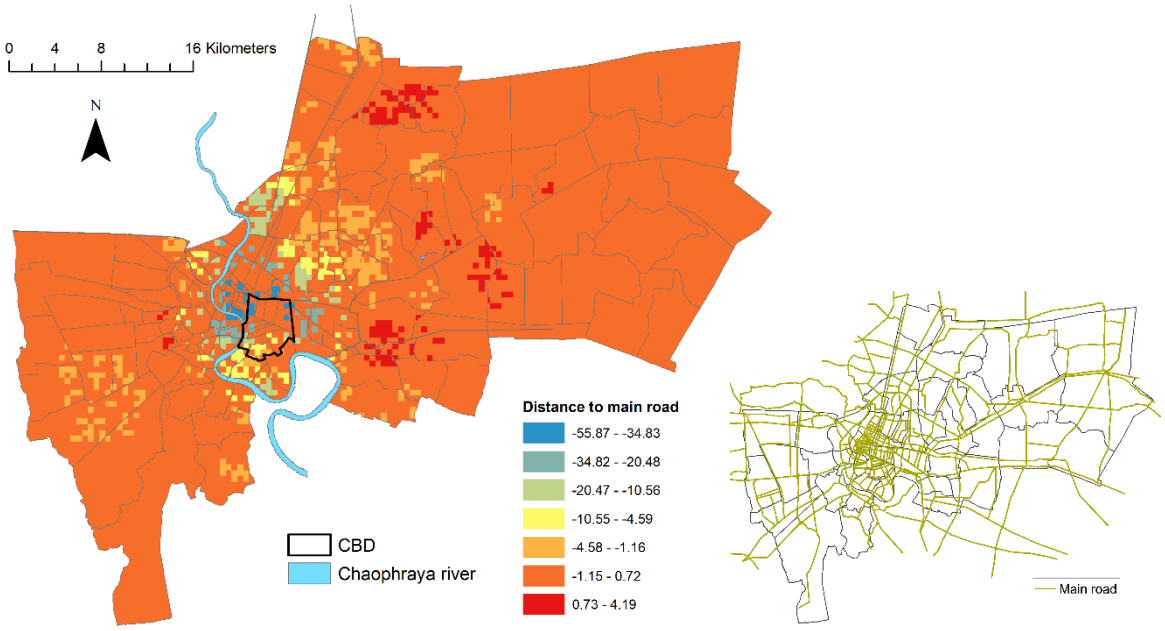

Figure 6.23 Distribution of the distance to main road parameter (GWR model A)

A further look at urban development level

In GWR model B, the assessed price variable is regressed on the same set of explanatory variables as GWR model A, but the property density variable is also included to see whether it can improve model performance as it did in OLS model C. The results in Table 6.14 suggest that the additional variable does not improve model performance, given the higher AIC value in GWR model B. The lower adjusted R-squared value in GWR model B also indicates that it accounts for a lower proportion of the variance of assessed prices (dependent variable), meaning that model A is a better fit for the data set.

The balance among parameter estimates in GWR model B seems to have improved but their relationships remain largely the same as in GWR model A. Inclusion of the property density variable results in an increase in the effects of the proximity to rail station variable in relation to the transaction price variable. The gap between the distance to main road and the distance to rail station coefficients is also narrowed. The property density reflects the development level of all areas of Bangkok, regardless of property types. Therefore, it can, to some extent, represent the notions which assessors have of an area based on its property density. It is found that the property density variable has a greater impact on assessed price than either the transaction price or the distance to urban rail station variables. This confirms our hypothesis that, in a mass appraisal system, urban development level plays an important role in the determination of assessed price.

Table 6.14 GWR model estimation results (model B)

Variable	Coefficients			
	Mean	Min	Max	SD
Property age	-26.2817	-143.9381	6.4280	38.1573
Building area	18.9641	6.4811	35.0308	7.4566
Land area	-9.2335	-17.0975	-2.9810	2.8578
Transaction price	0.2388	0.1473	0.3291	0.0417
Distance to rail station	-0.4128	-1.8863	0.3894	0.4156
Distance to main road	-1.6376	-12.6433	0.2010	2.2963
Property density	1.1226	-2.9207	3.2060	1.1766
Number of observations	3,673			
R^2	0.7026			
Adjusted R^2	0.6968			
AIC	74,303.98			

As shown in Figure 6.24, the spatial distribution patterns of the property density parameter estimate and property density levels (units per square kilometre) are similar. The density variable has a relatively greater impact on assessed price in west Bangkok, particularly in the boroughs of Thung Kru, Rat Burana, Chom Thong and Phasi Charoen. The impact is slightly reduced in the northern and southern fringes of the city. The findings suggest that new housing developments seem to have certain positive effects on assessed values due to higher sale volume of residential properties in the areas (PVB, 2016b). In contrast to the results outlined earlier, the lowest impact of the property density variable is evident in old residential zones within inner eastern suburbs. Part of these areas have been redeveloped and gentrified as a result of significant improvements in public infrastructure (Pankeaw, 2019). These areas are behind other parts of Bangkok in terms of an increase in residential units during the study period.

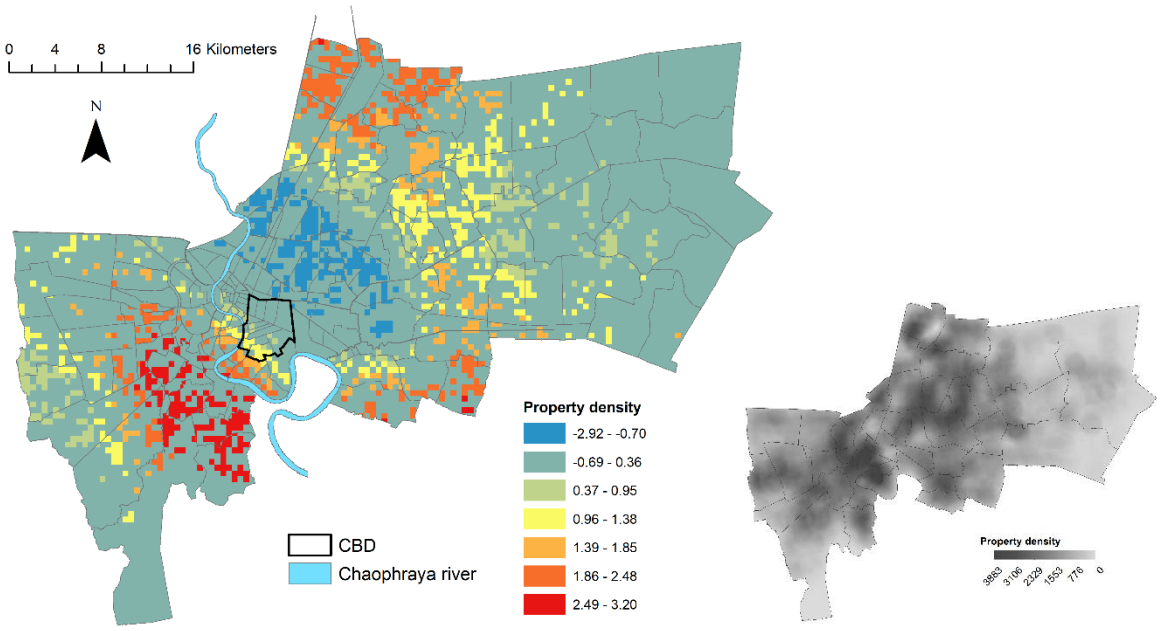

Figure 6.24 Distribution of the property density parameter (GWR model B)

6.5 Conclusion

In this chapter we have investigated property assessments within both spatial and non-spatial frameworks. The chapter began with the description of the data. The main data set is property records obtained from the Land Registry, which consists of all 2.14 million properties in Bangkok. The data is then merged with another data set obtained from the PVB. The second data set has been verified by assessors and contains comprehensive property attributes. The PVB also provided another set of data, which contains values of street units and their principle land use types. The analysis consists of four main types of residential properties, including terraced houses, shophouses, semi-detached houses and detached houses.

The preliminary analysis of assessed prices found that disparities between assessed housing land values and those of other types of land use exist in certain areas, especially in the eastern fringe of Bangkok. Assessed price disparities also exist within the assessed housing land values, which are mostly clustered in inner city areas. The analysis of the spatial distribution of assessed prices in relation to sale prices indicates greater disparities in suburban areas compared with the city centre. I then examined the changes in assessed prices during the three assessment cycles and found certain areas where assessed price levels remain largely unchanged, while assessed prices in other areas have markedly increased. The results confirm that, to some extent, assessment inequities exist, and they are unevenly distributed across the study area.

In terms of assessment uniformity, the ratio analysis found that assessment levels of properties with lower market values are higher than those of properties with higher market values. Evidence suggests that the assessed prices of high-value properties have been adjusted at a slower rate, which means that the assessment system is incapable of sufficiently increasing assessed prices for these properties. When considering the equity aspect of the assessments, it is found that horizontal and vertical inequities tended to exist in similar areas, mostly concentrated in the city centre and inner suburban boroughs. This was confirmed by the spatial distribution patterns of COD and PRD.

In the spatial analytical context, we began with spatial autocorrelation analysis. Local Moran's statistic revealed certain areas with irregularly high or low A/S ratios as compared with adjacent areas. In general, the CBD tended to exhibit relatively small numbers of assessment inconsistencies. Most of the clusters in the CBD were low-low

A/S ratios, which confirmed the findings that lower priced residential properties are inequitably assessed as compared with higher priced ones. This is potentially caused by the under-assessments of higher priced residential properties. In suburban areas of both sides of the city, more concentrations of clusters and outliers were identified. Essentially, there are two important findings regarding assessment inconsistencies. First, the street value assessment method is claimed to have a substantial impact on assessment level, as clusters and outliers of A/S ratios are found located along road networks with similar street values. Second, more assessment inconsistencies occur in areas where there is a greater increase in assessed prices than in areas where assessed prices have remained more stable during the past two assessment cycles.

Finally, in the regression analysis, the OLS tool was used to perform model selection. It was found that the model that includes both intrinsic and extrinsic variables performs better than the one that includes only the former. The nonstationarity in the data had certain effects on explanatory variables, especially the intrinsic ones, as the GWR results reflected different relationships between property characteristic variables. The GWR results indicate that property age is the most influential variable, followed by building area and land area. In contrast to our hypothesis, both transaction price and the proximity to urban rail transport stations have a limited impact on the variation in assessed prices. In terms of the spatial distribution patterns of the coefficient values, the results suggested that areas with low effects of location associated variables coincide with areas with assessment problems.

The following chapter will discuss the findings in relation to all of the research questions described at the outset of this thesis and conclude this study by offering implications and recommendations for policy, practice and future research.

Chapter 7 Discussion and Conclusion

This thesis has examined the property tax system in Thailand by using the assessed prices in Bangkok during the period of the past twelve years as a case study. The breadth of the data sets in this study has enabled us to analyse property assessed values in relation to market prices and other relevant factors that play an important role in the housing market.

This final chapter concludes the thesis by restating key findings and provides discussion based on property tax policies and research problems. The chapter is divided into five main sections. The first section summarises the findings obtained in this study, and discusses their contributions to existing theories and research methods. The second section discusses the main findings in relation to the research questions posed in the first chapter. The third section presents the implications of the findings in this research. The fourth section contains recommendations for property tax policy and future research. Finally, in the last section I present my personal reflections.

7.1 Summary of Findings

Empirical findings

The case study findings on the performance of property assessments demonstrates how they have been derived and distributed over geographical areas. Serving as property tax base, the property assessments were tested for their ability to reflect wealth, and thereby to inform tax collection. Property wealth is not directly investigated, but rather measured through two proxies: market price and urban development level. In this regard, for assessed prices to reflect property wealth, they are expected to be similarly distributed over geographical areas.

The preliminary analysis of assessed land prices shows certain areas of Bangkok where the level of assessed prices does not conform with the level of urban development, as defined by property density. When focused on residential properties, it is found that there are pockets of unevenly distributed clusters of assessed land prices throughout inner suburban areas, the patterns of which differ from the spatiality of other property classes. This presents a clearer case for assessment inequity, which is considered as one of the most pressing issues because property land values form the largest part of total assessed prices.

The analysis of both assessed and sale prices reveals similar patterns of price distribution, but higher levels of sale prices are noticeable in some areas. A wide disparity within sale prices should have resulted in the same pattern for assessed prices. However, it appears that the gap in sale prices is at least, on average, four times higher than that in assessed prices. More continuity in assessed prices reflects the nature of assessment practice, which confirms our hypothesis on the tendency towards limited and aberrant adjustment of assessed prices due to systemic and institutional constraints. Assessors are often pressured by peers and supervisors to maintain price continuity between different assessment areas. In such a system of mass appraisal, the convenience of having a predefined assessed price for every property is traded off against price accuracy and fairness.

The results of the assessed price analysis during the three assessment cycles (from 2008 to 2019) reveal two important findings. First, a significant change in assessed prices is evident in different suburban localities. During the reassessment in 2012, assessed prices for properties in most boroughs in north-western suburbs markedly

increased while those of properties in most boroughs in south-eastern suburbs remain largely the same. During the subsequent reassessment in 2016, however, assessed prices for properties in the north-western boroughs stagnated while those of properties in the south-eastern boroughs significantly increased. The situation suggests what I call an 'average out' of assessed prices over geographical spaces. Second, there are certain boroughs where assessed prices had remained relatively unchanged during the period of twelve years. This occurs in five boroughs in which property density is relatively high. The situation has raised concerns over property tax fairness that stem from the problem of under-assessment.

In the assessment ratio analysis, it is found that A/S ratios of residential properties throughout Bangkok do not follow the level of market prices. Assessment levels tend to decrease as market prices increase. The underlying assumption is that market prices reflect property wealth. Therefore, the lower assessment levels of properties in higher market price ranges indicate that a large part of property wealth remain untaxed. If we consider the results in relation to the Land and Building Tax structure, even where only a few of the wealthiest property owners are liable to the tax, the amounts payable are based on relatively low and inaccurate assessed values. This would restrict local revenues and create unevenly distributed tax base as the property tax becomes effective. If the exemption of the minimum taxable value of over 50 million baht is lifted, lower-value properties would be liable to proportionately higher tax due to the current level of assessment.

In terms of spatial distribution of assessment ratios, the results indicate that higher-value properties in suburban areas are subject to lower assessed values. It is also found that, in general, properties in inner city areas are assessed higher compared with those in other areas, regardless of the market value ranges they are in. This situation indicates that location has a great influence on assessment level for all types of properties. This problem is caused by the assessment practice, which does not elaborately differentiate properties according to their classes, and by a lack of accurate property data on actual property uses provided by the Land Registry. In this regard, local governments are required to start collecting their own property data solely for property tax purposes, which may not be consistent with the data collected by the Land Registry and the PVB as these organisations tend to have different purposes and incentives regarding the data collection.

The COD and PRD results confirm the conclusion drawn from the preliminary analysis that properties in suburban areas are more equitably assessed than those in inner city areas. The results are in fact considered from both horizontal and vertical equity grounds. The spatial distribution of the level of assessments implies, to some extent, the degree of assessment inequities as measured by the COD and PRD. Lower A/S ratios tend to result in a higher degree of horizontal and vertical inequities, and vice versa. However, assessed prices in Bangkok are far from meeting the IAAO standards in all three aspects of consideration: assessment level, horizontal equity and vertical equity.

The spatial autocorrelation analysis using local Moran's statistic reveals a similar number of high-low and low-high outliers but a discrepancy between the number of high-high and low-low clusters. Most of the significant statistics are located outside the CBD. In general, outliers of A/S ratios are smaller in number compared to clusters, and their spatial distribution patterns tend to be along secondary or tertiary road networks, with a few groups of low-high outliers located along main roads. In contrary, clusters of high-high A/S ratios do not seem to follow the spatial distribution of road networks but rather are concentrated in larger groups in certain parts of outer suburbs across the city. The spatial distribution pattern of low-low clusters is clearly different from that of high-high clusters as they are concentrated in smaller groups and are more dispersed. The results confirm earlier findings that the street value assessment approach adopted by the PVB has caused disparities in assessed prices in different geographical areas, and spatial inequities are rooted in assessment practices that follow the approach.

Finally, in the GWR analysis we dove deeper into the origins of assessment systems as certain factors affecting assessed prices were considered. Both of the GWR models that regress on assessed prices give similar results in terms of the relationship between a number of the most influential explanatory variables. Assessed prices are affected by property characteristics the most. Property age is the most influential variable in the models, followed by building area and land area. The results also reveal that distance to main road is more influential than transaction price and distance to urban rail stations. In model B, an additional variable (property density) has made transaction price the least effective variable and significantly improved the effect of distance to rail station. The property density variable itself has a relatively strong effect on assessed prices when compared against other non-property characteristic variables. Overall, assessed

prices are significantly affected by property age and area, which leads to the conclusion that the use of costs approach has overcome the influence of market prices in the property assessment system.

Theoretical contributions

Over the course of the previous six chapters, we have developed an understanding of property tax systems from a number of different perspectives, which do not always coincide. From an economic viewpoint, property tax is often considered to be a good and preferable tax, especially for local governments. Tax efficiency, however, largely depends on three components of property tax: rate, base and administration. We have found that all three components must perform well in order to make the whole property tax system efficient. For example, a well-designed tax rate structure can hardly perform if it is based on inaccurate property assessments, or if local governments use loopholes in property tax legislation in favour of some groups of people, they cannot collect sufficient revenues and inequities develop despite an accurate tax base.

The case study findings on property assessments suggest that property tax should be based on land values rather than combined values of land and developments, but a well-designed assessment system must readily be in place. In this regard, accurate land values can be derived from a cost approach based on sufficient and updated property data rather than on approximate costs of buildings. Property wealth can be represented by land value if development costs are precisely assessed and deducted from the whole property value. The issue of narrow base of LVT can be addressed by an adjustment of tax rates. However, this only applies in the case of residential property tax, in which property values can be represented by a large amount of transaction prices. In other cases, such as commercial buildings, it is more difficult to find comparable transactions for comparison and an income assessment approach should be used.

With regard to different views on property taxation, it is argued in this thesis that property tax burdens can translate to an increase in house prices (in the long run) only if the tax structure allows. In this case, property tax exemptions must be limited and should not be based on property value. They should instead be based on personal circumstances—e.g. income, employment status, number of occupiers, etc. Especially in residential property taxation, tax base should be wide enough to generate awareness in residents and accountability in local governments. In other words, ideally, every

resident should contribute property tax proportionate to their property wealth—or value of the property they live in—as defined by market values.

Furthermore, I argue against the capital tax view that considers property tax as a distortionary tax. Given a nationally designed tax rate structure, accurate assessment and appropriate zoning of tax jurisdictions will improve distortion problems in property tax systems. Accurate property assessments are the key to avoid resistance from taxpayers and minimise inequities that may arise from poor tax administration. However, this argument is not based on the exaction process proposed by Fischel (2001), whereby local governments are able to maximise tax collection by collecting tax deficits as side payments from developers. The process is viable in theory but difficult to implement in Thailand because of the diversity of land uses, lack of accurate tax base, and limited expertise of local governments in property assessment.

As many countries including the UK have adopted banding assessment systems, it is argued that this is not an appropriate solution for property tax base. The argument is based on the heterogeneity of the property market and various facets of housing ownership. In order to meet the equity principle of taxation, housing assessments cannot be grouped into a few price ranges. Regardless of tax rate schemes, assessed prices must be regularly updated instead of sacrificing assessment accuracy for popularity of property tax and cheaper, less time-consuming reassessment.

This study has confirmed the theory proposed by Lin (2010) that spatial inequity arises when property assessments fail to reflect certain location-associated price-determining factors. By comparing the GWR results with the spatial distribution of assessed prices, it is found that areas in which the effects of neighbourhood characteristic variables are relatively low are the same areas where assessment problems exist. The results in this study agree with the findings of Bae et al. (2003) on the limited effects on house prices of urban rail transport lines after they have opened. This study has also performed further GWR analyses on top of those done by Malaitham et al. (2013) for which there were only two BTS lines and one MRT line at the time. The impact of eight additional urban rail transport lines is included in the analyses and presented on more extensive geographical areas.

Methodological contributions

The aim of the methodology is to present more comprehensive analyses on housing assessed and sale prices. The distinction of the methodology in this study is the combination of three analytical approaches that are beneficial to each other. All methods are useful in analysing not only house prices but also mass appraisal systems. As a result, we could easily identify the geographical areas where assessment problems exist and measure the impact of various housing and neighbourhood attributes on assessed prices. The results offered us an opportunity to thoroughly evaluate the property tax systems and quantify the level of inconsistencies in assessed prices along with their important determinants.

Although each method used in this study is not new to housing research, the interpretation of their results in relation to each other gives concrete evidence at least for the confirmation of assessment inequities and for the identification of problematic localities. The extent of the data used and the comprehensiveness of analytical methods adopted in this study are unprecedented in property tax research in Thailand. This has allowed us to produce substantial quantitative measures for the evaluation of the property assessment systems, which is beneficial for the improvement of future property tax policies in Thailand.

In this study, GWR models regress on assessed price, not on A/S ratios as in other studies (Gilderbloom et al., 2012; Payton, 2012). Sale price is assigned as an independent variable to determine its relative influence on assessed price. The results give us deeper insights into the assessment processes, which are useful in identifying actual causes of assessment errors. The analysis of property assessments also reveals an interesting relationship between variables, in which locational and market attributes seem to have less impact on assessed prices than property attributes. This distinct aspect of the method used in this study has therefore produced an alternative for the evaluation of property assessments across different jurisdictions.

7.2 Discussion

In the first chapter I outlined six questions that need to be addressed by the outcomes of this research. The first question was about the uniformity and progressiveness of the assessed price. Assessment ratio analysis found that assessed prices in most Bangkok boroughs fail to meet the IAAO standards. The median A/S ratio analysis reveals that only five out of fifty boroughs can meet the standards, and the rest are largely under-assessed. Therefore, it is concluded that, in most parts of Bangkok, there is a lack of uniformity among property assessments of all value ranges. When comparing A/S ratios with property market prices, it is found that overall assessed prices in Bangkok were regressively distributed. A/S ratios tend to reduce as property prices increase. The difference between the average A/S ratios of properties in the highest value range (the fifth quintile) was almost twice as low as that for properties in the lowest value range (the first quintile). This clearly indicates that tax base is significantly regressive on its own. Even tax rates are progressive, it is likely that the regressive effects of tax base will offset the progressivity in tax rate, which will yield regressive tax burdens as a result.

The discrepancy between assessed and market prices is measured by the levels of A/S ratios, and the results are mapped to show their spatial distribution patterns. The results indicate that the discrepancy is more pronounced in suburban areas, especially the inner ones. The lowest discrepancy of A/S ratios is found in the inner areas of Bangkok including the CBD and some recently gentrified areas to the north of the city. It is also found that boroughs in both eastern and western fringes of Bangkok have average assessment levels higher than boroughs that are closer to the city centre. Boroughs with particularly low levels of A/S ratios are mostly new catchment areas for urban rail transport lines, which are located on both sides of the city. The results suggest that, in the next cycle, assessed prices in these areas (Bang Bon, Bang Khae, Chom Thong, Wang Thong Lang, Suanluang and Prawet) need to be thoroughly compared with sale prices.

Areas with disproportionately high discrepancies are either boroughs where new lines of urban rail transport have recently been built or outer suburbs where there are increasing number of gated housing developments and educational institutions. In Lad Krabang, for example, there has been expansion of a public university, outer ring roads and airport rail link, which resulted in more housing developments to

accommodate a higher number of students and workers. Other areas with relatively high assessment to market price discrepancy seem to have similar characteristics, particularly developments in public infrastructure that tend to attract more residents to the areas.

Systemic biases of property assessments are identified by the spatial autocorrelation analysis and the GWR. It is found that assessment practices and certain assessing methods are the main causes of the problem. In fact, these causes are further exacerbated by the nature of mass appraisal systems, which require assessors to process a considerable number of properties in a limited timeframe. Accordingly, assessors are required to adapt their assessing practices and methods to cope with these challenges, which seems to have resulted in assessed prices diverging from market values. In the case of Bangkok, the street value approach had been used in assessing all properties during the study period, which had caused disparities in assessments to be unevenly distributed over geographical areas. The distribution patterns of particularly under-assessed properties and of groups of high-high A/S ratio clusters are consistent with the assessment approaches adopted by the PVB. It is also found that the cost approach used to derive land value was the main cause of assessment inconsistencies, as shown by the GWR results. It is evident that the higher assessed price adjusts, the more impact the cost approach has on the level of assessments.

In general, owners of higher value properties in certain outer suburban areas have benefited from assessment biases as they are subject to proportionately lower assessed prices. In terms of housing classes, terraced houses (townhouses) in suburban areas, in particular, are mostly under-assessed. Disadvantaged groups are owners of lower price houses, especially those that are located in inner city areas. In areas where there is a lower proportion of housing to other types of properties, lower price houses seem to be assessed higher because the assessment practices do not clearly differentiate sale data according to actual land uses. In this situation, it is found that housing types do not have much influence on assessment levels. It is property location that plays a key role in assessed price setting.

What the results in this study suggest is that market assessment approach is certainly necessary in deriving accurate assessed values. The combination of market and non-market assessment approaches has caused biases and higher dependency on the accuracy of property attribute data. Mass appraisal of housing should be based on

frequently updated sale and property data, which can be achieved only if there is cooperation between government agencies. There should be a unified government data centre incorporating vital information, which can support the work of most government agencies. Computer-assisted assessment systems that utilise spatial regression techniques can be used but they must provide different models for different classes of properties. The use of such systems, however, should be limited to the update of assessment values, which means frequent surveys and market comparison assessments are mandatory.

LVT is clearly an appropriate method of assessment, which can be traced back to Ricardo, Henry George and Lloyd George. Taxes imposed on land alone assume that the land will be used to its most profitable potential (highest and best use), involving development which is usually subject to planning regulations. LVT is seen as a tax on the ownership of land, considered as an asset, rather than a tax on its economic use or development (Dye and England, 2010; McCluskey et al., 2007). In this sense, LVT is a tax directly imposed on economic rent, which is considered efficient. However, there are three major limitations to LVT. First, LVT may not be able to raise sufficient revenues for local governments due to restricted tax base. Therefore, local governments may have to increase tax rates in order to maintain sufficient revenue levels. Second, LVT should be implemented only when assessors have reliable property attribute data and accurate structure costs, otherwise the problem of inequitable tax base may arise. Finally, as with other types of property tax, LVT is not neutral, either in terms of the location or density of development (Dye and England, 2010). Lowering the tax on structure can lead to opposing results: either an increase in the demand for larger housing at the urban fringe as its cost decreases or an increase in the number of structures being built on a given area (Brueckner and Kim, 2003).

An alternative to LVT is split-rate property tax, which differentiates land from improvement. Land is taxed at a higher rate because, as previously mentioned, it is economically reasonable to do so. Buildings are taxed at relatively lower rates to minimise deadweight loss. The advantages of the split-rate property tax can be viewed from two scenarios. First, moving from the conventional property tax, in which the same rate is imposed on both land and buildings, to the split-rate tax can lower deadweight loss due to lower rates imposed on buildings and higher rates imposed on land, assuming that total tax revenues remain unchanged. Second, the reason for

moving from an extreme case of a pure land tax to the split-rate property tax is that it is a more practical alternative. The split-rate property tax tends to increase incentive for developments on small lots because buildings are liable for lower tax rates, which would lead to a higher level of economic development, particularly in cities experiencing economic decay (Cohen and Coughlin, 2005). However, one of the disadvantages of the split-rate property tax is that, as with LVT, there are transaction costs arising from the valuation of land independently from built structures (OECD, 2011).

7.3 Implications

Given the above conceptualisation, it is clear that property assessment for tax purposes is a challenging task. The analysis in this study has provided enough evidence to confirm that residential properties should be the main base for property taxation due to the extent and scale of housing distribution and the benefits that residents receive from local governments. Accordingly, property tax exemptions for residential properties should be kept to a minimum, regardless of the degree of political resistance at the point of first implementation of the tax. In particular, LVT of residential properties is preferable to other types of property tax as it tends to cause less economic distortions. Improvements should be taxed at a minimum rate or exempted from tax if possible.

In the design of the Land and Building Tax structure, policymakers should be informed that each tax jurisdiction has different levels of urban development and property type/value compositions. Therefore, a single tax rate and base scheme can hardly be applied to all boroughs. Local governments should be given power to determine their own property tax rates within certain limits, without which tax competition between jurisdictions is likely to result in their not being able to collect sufficient revenues to finance local services. Neighbourhood and housing submarket are not synonymous but they have a straightforward relationship (Galster, 2008). Property tax zones can be different from administrative boundaries if this helps create a more evenly distributed tax base.

Following the benefit view of taxation, tax base should be clearly classified according to property uses. In this regard, assessment methods for residential properties should be separated from those of other property classes due to the different benefits they receive from local authorities. Ideally, residential property tax should be singled out from other property taxes to avoid complexities in assessment processes. Market assessment approach should be prioritised over other approaches due to its ability to derive market values and typically large volumes of housing transactions. For other types of property taxes such as the one on commercial properties, their assessments should be combined with, for example, corporation tax so that extortions or double taxation can be mitigated or avoided.

This study has demonstrated how property tax inequities arise from inconsistencies in housing assessments. The scope of the study area has proved beneficial for the

analysis of the performance of the property tax system. However, the limited availability of data on other property classes and demographics has impeded this study from performing a more comprehensive analysis on the entire property tax system. Future research can make use of increasingly available data to perform comparative analyses of different types of properties, and to investigate impact of other demographic variables—e.g. household income and education level. This will certainly give us a better insight into other pressing problems such as income inequality and displacement.

The evaluation of assessed prices in this study forms a basis for further research on tax incidence, which can develop based on the findings on spatial variations in housing prices. Specifically, assessment coverage ratios can be compared with final taxable values and tax liability to identify potential causes of, for example, variations in tax revenues, and measures that can be used to increase tax collection. Such research would benefit from the inclusion of data on personal circumstances, which can help determine tax exemptions and reductions. The determination of tax rates in the policymaking process would also benefit from the findings on the causes of disparity in assessed values. As this study has proved that the top determinants of assessed prices are property-specific, policymakers should be aware of this fact when designing tax rates or exemptions/reductions that vary by property types.

Furthermore, it should be noted that the effects of property assessment disparity on renters are not explored in this study. The analysis in this study is based on the assumption that tax burdens completely fall on property owners. Policies aiming to mitigate property tax effects on low-income households should be mainly based on the rental housing market because, particularly under current market situations, not many people on low income can afford to buy. As well, types of housing are not always a good representative of the income levels of occupiers. Locations, neighbourhoods and submarkets can also reflect income levels. Therefore, all of these factors must be accounted for in the processes of property assessment and tax rate determination.

7.4 Recommendations

Earlier in this thesis, I argued that the origin of property tax inequity is rooted in the property assessment system. A property assessment system begins with property data collection by the Land Registry, which requires a legal system that must be well-functioning in order to provide accurate property data. This should be set as a goal in the long run. There should be, at the least, cooperation between the Land Registry, the PVB and urban planning authorities to share the same database. By achieving this, the government sector can tremendously reduce administration costs, improve its service quality and shorten policy implementation timeframes.

In the short run, reassessment should be carried out more frequently. I would suggest that a two-year cycle should allow for inaccurately assessed prices to adjust more quickly, resulting in a narrower disparity between assessed and market prices. However, this will certainly put more time pressure on assessors, who will have to complete the same tasks twice as quickly. The issue can be addressed with the use of new technology to store vital data and decrease processing time between property survey and assessed price determination. If a well-functioning data storage and sharing system is established, confidential data can be securely shared between government authorities, which will help shorten the duration of the assessment process and gain the trust of taxpayers. In addition, a more efficient property record keeping system will facilitate the assessment appeal process by reducing review and reassessment time, which will make property tax easier to administer. All of these components form a fundamental basis for a more equitable property tax system.

Furthermore, the property assessment process can be improved by incorporating location and demographic variables into assessment models. As evident in this study, assessed prices are largely influenced by property-specific variables such as property age and building area. This is problematic due to the fact that structures should not be the main part of tax base. To guard against the worsening of this situation if the government were ever to decide to replace the Land and Building Tax with, for example, a split-rate property tax, the PVB should develop assessment approaches that reflect more dimensions of the housing market. The property tax base in Thailand is in fact suitable for split-rate property tax and LVT because the components of land and structure values are already separated. An additional effort has to go into making the structure costs more accurate and expanding the breadth of market price data.

With respect to the improvement of the assessment approach, my suggestion is to adopt GWR or other spatial hedonic regression techniques as a principle analytical method. A separate regression model can be constructed for each housing submarket, which is determined by land use zoning, planning regulations, neighbourhood types, etc. However, Glaeser (2007) cautions against hedonic modelling on account of its limited ability to reflect the average willingness to pay of residents across the population. He asserts that, on a conceptual level, housing prices can only reflect the willingness to pay of the marginal resident in certain areas. This issue requires thoughtful interpretation by the researcher. Another issue is that hedonic estimates are compromised of correlations between observed submarket/neighbourhood attributes and the error term in the regression. No matter how hard we try to control for area characteristics, these are almost impossible to measure perfectly in practice. Such bias can be mitigated by lowering the level of analysis to the degree where we can be more confident that submarkets/neighbourhoods are comparable (Ibid.).

Areas for future research would include testing the performance of the Land and Building Tax after it becomes effective in January 2020. Capitalisation effects of the property tax can be measured from an increase in market price, but this has to be done in relation to other important price determinants, potentially by spatial regression modelling. For instance, a study may compare urban rail station proximity premium values between different catchment areas. The results of such analysis would help the central government to better determine appropriate future tax rates and give local governments more information on how to improve their property tax administration. Furthermore, additional research can be done at a more specific spatial scale—i.e. a case study of several neighbourhoods. The use of mixed-research methods that include, for example, in-depth interviews and focus groups would give researchers more insightful information that may help them understand the perceptions of taxpayers toward the tax.

On the relationship between income distribution and property wealth, further research should be carried out on residential property submarkets that reflect social class difference. Detailed census data would particularly benefit this research. The data sets should at least include the following socioeconomic aspects: household composition (e.g. number of people, sex and ethnic origin), household expenses, occupation/employment-related industry, place of work, income range, educational

attainment, population density, labour force participation, and place of usual residence. It is also important that geographies are included in the data sets, ideally at the finest level possible. If data permits, a comparative study of the policy outcomes of property tax in relation to other taxes such as personal income and value added taxes would produce more insightful results on the net level of tax burden, and would allow us to compare distortions caused by different taxes.

By incorporating the census data with information on buildings—e.g. living quarters, offices and commercial facilities—as well as data on travelling patterns, planning regulations and macroeconomic indicators, it is possible to explore the distribution of housing prices through more sophisticated hedonic models. Obviously, there are other aspects of the housing market that are beyond the scope of this thesis. Housing prices are certainly influenced by factors other than property-specific ones. Simply covering demand-side factors that affect an individual's decisions is not enough to explain the change in housing prices. Market equilibrium is determined by both demand and supply quantities. Factors affecting housing supply like land use restrictions, construction costs, housing stocks and structure of land ownership should also be included in future studies to achieve a more rounded understanding of the workings of the housing market.

Moreover, it would be interesting to explore housing markets across cities. A study of this sort would certainly benefit from the Rosen-Roback model, which allows for the fact that income and amenities differ across space (Roback, 1982; Rosen, 1979). The model treats the metropolitan area as a single indifferent entity, so that transport costs, housing prices and amenity levels are homogeneous. Additional aspects that can be covered in such a study would be the interaction between wages, amenity levels and housing costs. An expanded version of the model was constructed by Gyourko and Tracy (1991) to study the effects of intercity fiscal conditions on the quality-of-life index, which reflects the willingness to pay (to live in a city). Their results show that intercity fiscal differentials are almost as important as amenity differentials in determining the quality of life. Therefore, high housing prices reflect not only high income of residents or high levels of amenities but also better fiscal conditions. The key takeaway from the research is that the local quality of life may be more malleable than we have previously expected as fiscal conditions are under the control of local

governments. Future study would benefit from the incorporation of commuting and migration data with conventional property variables.

Regarding inequities in the housing market, I believe the area that has largely been neglected in the growing body of studies is low-income housing. Policy debate on the topic appears to revolve around the effectiveness of supply-increasing strategies in response to the problem of slum housing. In many countries, one of the most popular solutions is to increase the supply of public housing, with the main objective of substituting it for low-quality private housing. A traditional method of policy implementation is to directly or indirectly boost the supply of public housing via public or subsidised private units (Weicher, 1979). But such a policy has been questioned by Muth (1975) as being counterproductive due to the elastic long-term supply of private low-quality housing. It has also been found that the subsidisation of private housing units such as the Help-to-Buy scheme in the UK, for example, overly focuses on stimulating the demand but fails to expand the supply, resulting in a housing affordability crisis due to housing shortage (Hilber and Schöni, 2016). Further studies on the problem are required to produce more effective policy recommendations.

7.5 Final Reflections

The analysis provided in this study has expanded our view on property taxation and the processes behind this unpopular tax. Property tax is certainly a good tax in theory but often not a successful one in practice. It has probably created more fears than any other taxes have in the modern world despite its low significance in terms of revenues in most countries. I hope that this study helps develop an understanding of the tax to some extent. The central lesson to be learned from this study is that every tax has the potential to be a good tax, it just depends on the way it is designed and implemented. Most existing problems in property tax systems are not inherent, rather they are the results of neglecting the importance of local fiscal adequacy. Property assessments, for example, require regular update to maximise property tax coverage ratio, but, as we see in many countries, they are left to become obsolete. What this study has shown is that many realistic measures can be taken to alleviate assessment problems if policymakers can make informed decisions regarding the assessment process.

Property tax has enormous potential for wealth distribution and local government revenue. There is no investment that can create wealth to the extent that property can, particularly in the long run. The logic of wealth tax is that excessive wealth accumulation is a result of market failure and the government's inability to design appropriate policies to eliminate economic rents. If the economic rents are left untaxed, there is a gap for property owners to accumulate wealth faster, which will certainly exacerbate economic inequality problems. Therefore, wealth tax is the most reasonable fiscal policy option to redistribute and allocate capital. The redistribution of capitals takes two principle forms. First, the rate of accumulation of rental income is moderated by imposing higher tax rates on investment properties relative to owner occupied ones. Second, the accumulation of property wealth is slowed and prevented by taxing net wealth or imposing maximum rates on unutilised properties—e.g. unoccupied houses and vacant land. The allocation of capital can be achieved by ensuring that property tax is locally collected and spent.

One of the main reasons for the difficulties in property tax reform is that legislation can hardly be amended in a short time due to rigid law-making processes and political resistance. This largely concerns the revision of property tax rate and administration. However, property tax base is a relatively flexible function, which can be more easily altered. With advancements in computer programming, reassessments can be achieved

faster and more accurately than ever before. One of the essential requirements is that assessments must be supported with reliable evidence.

I believe I have shown that improving the property tax system is not only achievable, but also essential in light of the need for social equality and honouring our responsibilities to our fellow citizens.

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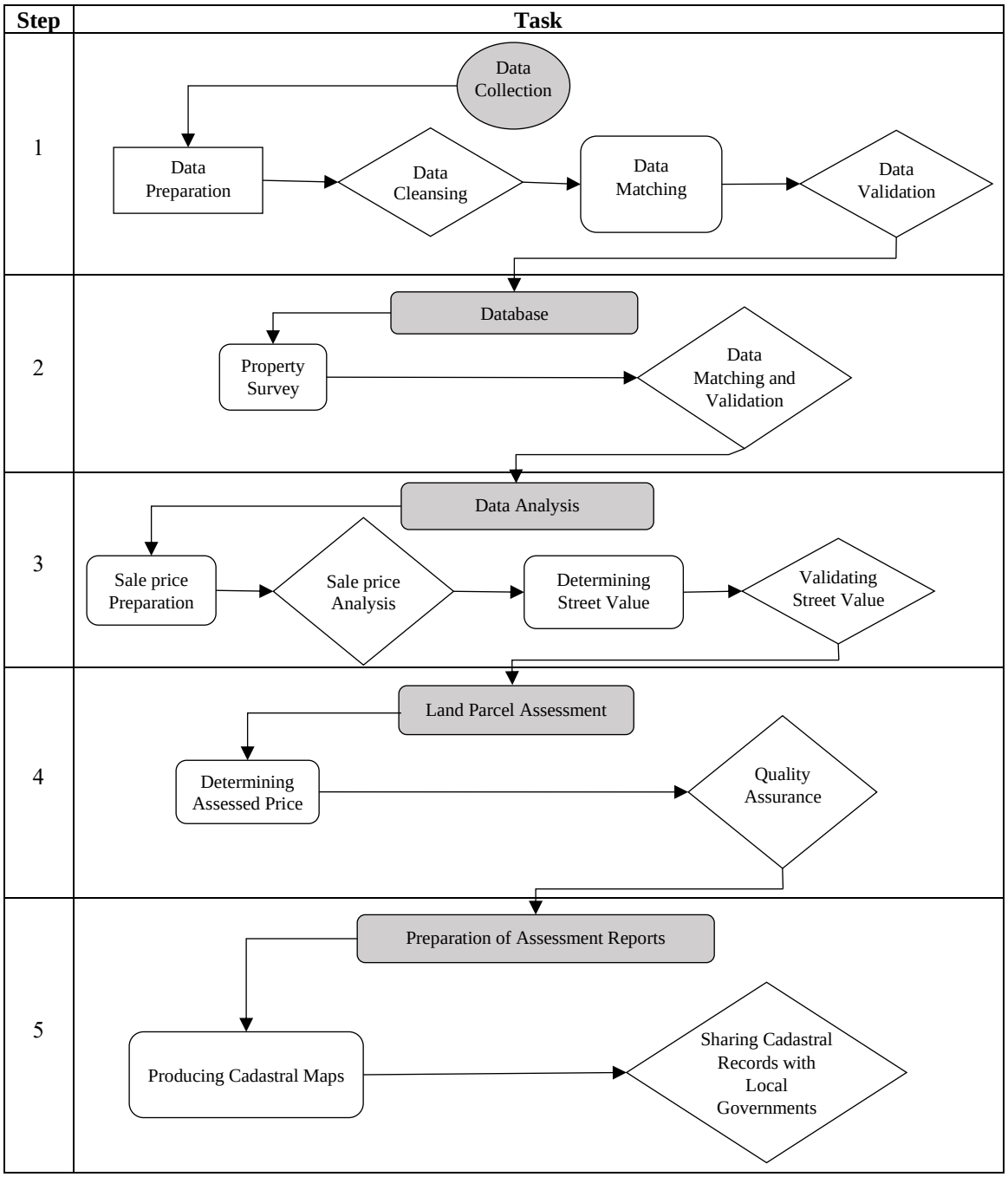
Appendix A: Depreciation Factors Used by the PVB

Building Age	Year 1-5	Year 6-10	Year 11-15	Year 16-20	Year 21-42	Year 43 onward
Concrete/brick	1% per year	1% per year	2% per year	2% per year	2% per year	76% deduction
Concrete/brick and wooden	2% per year	4% per year	4% per year	5% per year	85% deduction	

Building Age	Year 1-5	Year 6-15	Year 16-18	Year 19 onward
Wooden	3% per year	5% per year	7% per year	93% deduction

Source: PVB (2009)

Appendix B: Property Valuation Process of the PVB



Source: PVB (2009)

Appendix C: Additional GWR Results (Model B)

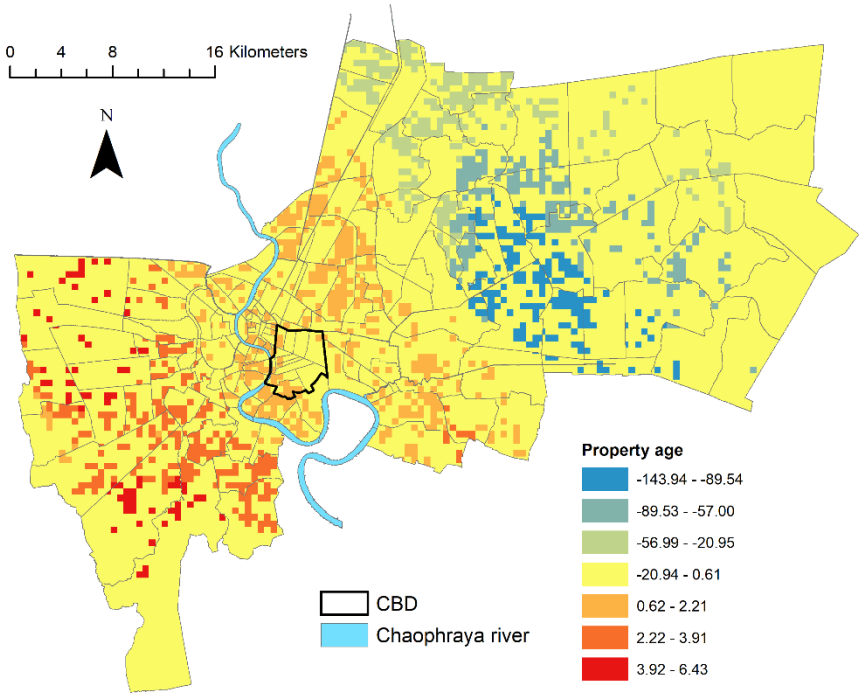


Figure C-1 Distribution of the property age parameter

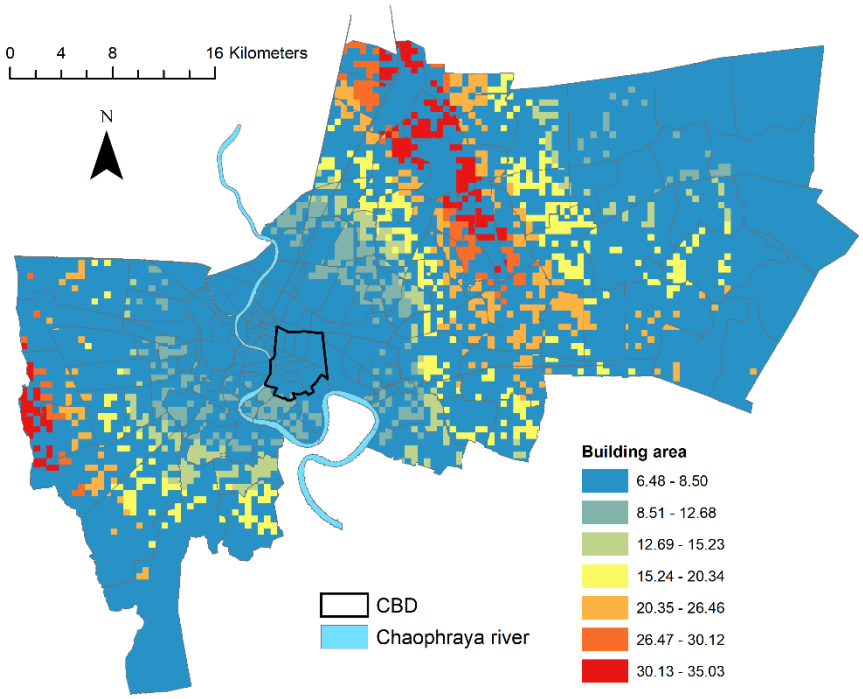


Figure C-2 Distribution of the building area parameter

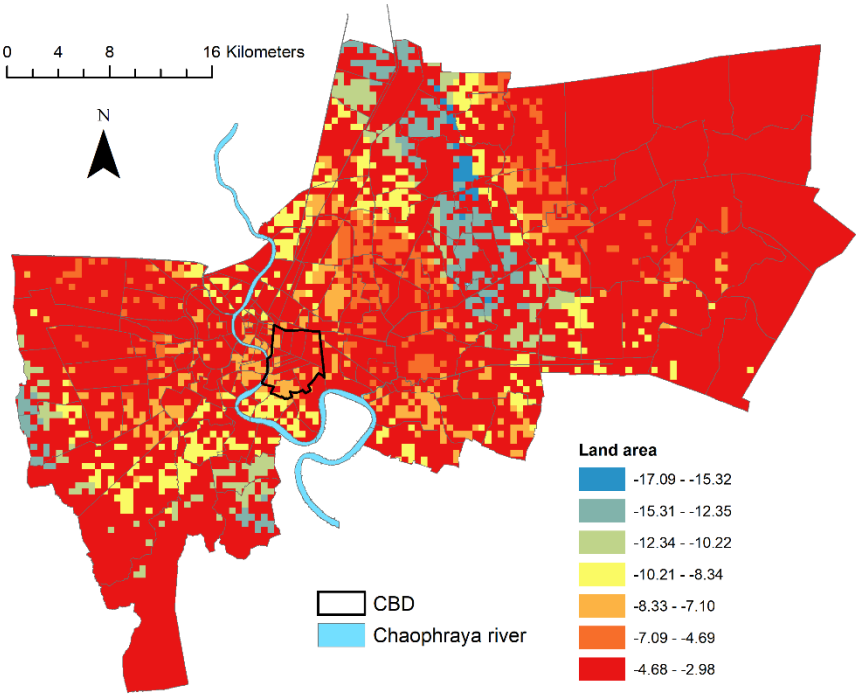


Figure C-3 Distribution of the land area parameter

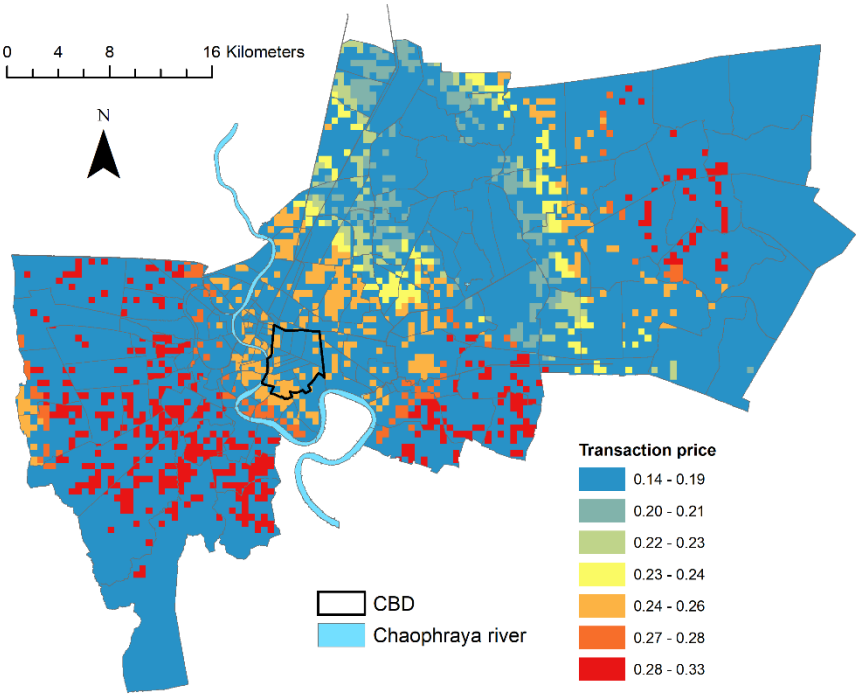


Figure C-4 Distribution of the transaction price parameter

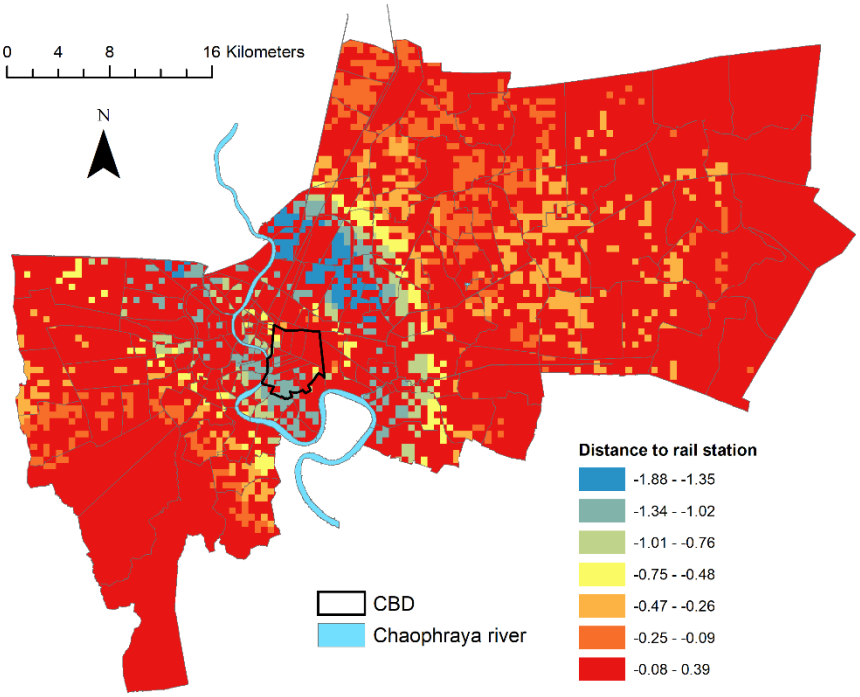


Figure C-5 Distribution of the distance to urban rail station parameter

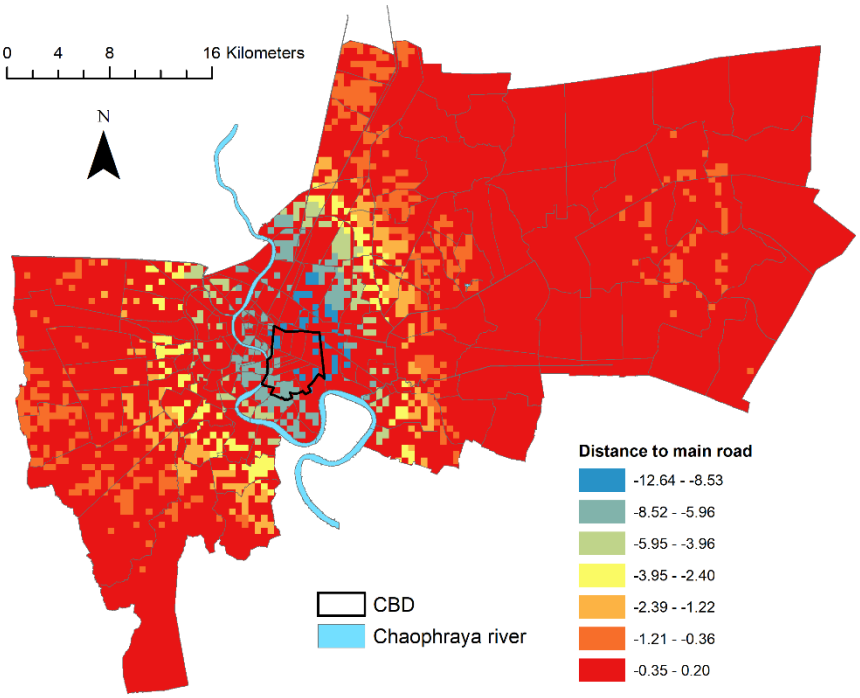


Figure C-6 Distribution of the distance to main road parameter